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PART II

ENVIRONMENTAL PROTECTION AGENCY

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AIR POLLUTION CONTROL

Certification and Test Procedures for New Motorcycles; Emission Regulations and Appendices

Title 40—Protection of Environment

CHAPTER 1—ENVIRONMENTAL PROTECTION AGENCY

[FRL 659-1]

PART 86—CONTROL OF AIR POLLUTION FROM NEW MOTOR VEHICLES AND NEW MOTOR VEHICLE ENGINES: CERTIFICATION AND TEST PROCEDURES

Emission Regulations for New Motorcycles

On October 22, 1975 a Notice of Proposed Rule Making (NPRM) was published in the FEDERAL REGISTER (40 FR 49496) for the control of exhaust and crankcase emissions from new motorcycles. Comments by interested parties to that NPRM received prior to February 10, 1976 were considered in the preparation of this final rule making.

Basis for motorcycle regulations. In the development of the final rule making, the effects of motorcycle emissions on ambient air quality on a national basis and in certain air quality control regions were reevaluated. Even with the use of reduced growth rates as recommended by some of those commenting on the NPRM, the analysis concludes that the control of motorcycle emissions is a reasonable strategy to reduce air pollution caused by motor vehicles. The projected contribution of motorcycles in 1985 ranges from 3 to 18 percent of the hydrocarbons and 3 to 5 percent of the carbon monoxide allowable to meet ambient air quality standards in the five air quality control regions assessed. In the time frame considered no single source will be a major contributor, and meeting the ambient air quality standards will require control of many sources each of which considered individually may not be a large contributor to air pollution. However, control in the aggregate will contribute significantly to needed reductions in ambient pollutant concentrations.

Emission standards and implementation dates. The NPRM contained proposed emission standards for 1978 and 1979 model year motorcycles of 5 grams/kilometre (5 g/km or 8 g/mi) hydrocarbons (HC) for engine displacements less than 170 cc, 5 to 14 g/km (22.5 g/mi) for displacements between 170 cc and 750 cc and 14 g/km above 750 cc. The carbon monoxide (CO) and nitrogen oxides (NOx) standards proposed were 17 g/km (27.4 g/mi) and 1.2 g/km (1.9 g/mi), respectively. For model year 1980 and later it was proposed that motorcycles be controlled to the ultimate light duty vehicle standards set forth in section 202 of the Clean Air Act, as amended, 42 U.S.C. 1857f-1 (commonly known as the "statutory standards"). In general the response to the proposed action was that the 1978 standards were achievable but that implementation of the statutory standards was not technically feasible as early as 1980, and that control to that level would not be cost effective.

An analysis of the costs and lead time for the 1978 standards confirmed that the proposed levels are a reasonable and cost effective means of control, and therefore, with the exception of the NOx standard, they are hereby being promulgated as proposed. The NOx standard has been deleted because an air quality analysis indicates that the motorcycle contribution to motor vehicle NOx emissions is negligible, being less than one half of one percent in 1990.

The analysis of the 1978 standards revealed that a level of control more stringent than the 1978 standards is feasible for model year 1980 at reasonable costs using available technology. Two levels of HC control, both of which eliminate the displacement dependency of the HC standard, were evaluated. These levels were 5 g/km HC (8 g/mi) and 2 g/km HC (3.2 g/mi). The 5 g/km standard proved to be as cost-effective as the 1978 standards and achieved only slightly less control than the 2 g/km standard. The analysis indicated that the 5 g/km HC standard could be implemented in 1980; the 2 /km standard would require several years more lead time to avoid major disruption to the industry since it is likely that most two stroke motorcycles would need to be converted to a four stroke design to comply with a 2 g/km standard. Based on this analysis, a follow-on standard of 5.0 g/km HC and 12 g/km CO applicable for the 1980 model year is hereby being promulgated. Data indicate that the 12 g/km (19.3 g/mi) CO level is achievable at low cost using available technology.

The 1978 standards will result in an average 34 percent reduction in HC and an average 36 percent reduction in CO emissions compared to the uncontrolled motorcycles. The 1980 standards will increase these percentage reductions to 54 and 49 percent, respectively.

The proposal for the 1980 motorcycle standards equivalent to the light duty vehicle statutory standards is being withdrawn at this time. Depending upon future air quality needs and the determination of the cost effectiveness, the Agency may, in the future, repropose those levels of control to become effective in the time frame beyond 1980.

Economic impact. EPA studies using information supplied by various manufacturers indicate that the cost of compliance with the promulgated emission standards for 1978 will result in an average increase in retail cost of 47 dollars per motorcycle. This cost will be partially offset by an average discounted lifetime fuel savings of 33 dollars and an undetermined savings in maintenance and improved reliability of the product. The average incremental cost increase for the 1980 standards is estimated to be $9 which includes a small additional improvement in fuel economy. The manufacturers estimated that fuel economy improvements associated with the 1978 emission standards would range as high as 65 percent with an average increase of 20 percent. No significant decrease in sales or shift in market shares (between manufacturers) is expected to result from the implementation of this regulation.

Applicability of emission regulations. The motorcycle definition has been changed to include 2 wheel vehicles and all 3 wheel vehicles having a curb mass of less than or equal to 680 kilograms (1500 lbs.). This definition provides objective criteria for determining a vehicle's class while maintaining consistency with the previous light duty vehicle motorcycle exclusion.

The preamble to the Notice of Proposed Rule Making stated that under the Clean Air Act, the EPA does not have the authority to prescribe standards for vehicles not designed for use on streets or highways. Some confusion was expressed by commenters over what constituted a motorcycle designed for use on streets or highways. The applicability section has been rewritten to state that these standards apply to new motorcycles which have a headlight, taillight and stoplight.

The applicability to only those motorcycles with displacements of at least 50 cc remains. Motorcycles with top speeds under 40 km/h (25 mi/h) or which cannot start from a stop using power from only the engine (e.g. most mopeds) have been excluded.

Certification procedure. In an effort to minimize the costs and certification time while obtaining reasonable assurance that newly manufactured motorcycles will comply with the standards for their useful life, substantial changes to the proposed certification procedure have been made.

The NPRM proposed that durability vehicles accumulate the entire mileage defined as its useful life and that a deterioration factor be calculated from the emissions test results for this vehicle. Then a separate (emission data) vehicle, calibrated to production specifications would accumulate sufficient mileage to stabilize emissions and compliance would be determined by applying the deterioration factor to this level of emissions. Under the promulgated procedure, the emission data and durability vehicles will be combined into one certification test vehicle and the test distance reduced to one half of the useful life distance. Cutting in half the test distance will reduce the lead time and cost required to accumulate test mileage and will permit the use of production calibrations on vehicles used to calculate deterioration factors. By combining durability and emissions data vehicles into one test motorcycle calibrated to production specifications, and by testing one such vehicle for each engine family-displacement system combination, added confidence in the representativeness of the resulting deterioration factor is gained.

Another change made to the certification procedures concerns test vehicle selection. The product line is grouped, by engine displacement in cubic centimetres (cc), into three vehicle classes. These classes are: I, 50–169 cc; II, 170–279 cc; III, 280 cc and greater engine displacement. Within each class the vehicles will further be grouped by engine family-displacement-control system combinations. Within each combination EPA will select the "worst case" vehicle to be tested for the purpose of demonstrating compliance with the emission standards. Only one

vehicle per engine family-displacement-control system combination will be selected for such testing. For engine families with less than 5000 annual sales, the manufacturer may request that only one vehicle per engine family be selected.

The test vehicle will be built to production tolerances and will accumulate distance to one half its useful life. A minimum of four emission tests performed by the manufacturer will be required, and from these data a deterioration factor line will be calculated and extrapolated to the useful life. If the deterioration factor line is below the standard, or all test points are below the standard, the vehicle will then be tested by EPA. If the results of applying the deterioration factors multiplicatively to the EPA test results are also below the standard (and all other procedural requirements are met), certification will be granted. For vehicles whose emissions exceed the standard when projected to the useful life, the manufacturer may elect to continue service accumulation to the useful life and demonstrate that emissions throughout the useful life will be below the standard.

Several comments were received requesting exclusion of low volume manufacturers from the regulations. An analysis of the effort required to reduce emissions to the promulgated standards revealed that low volume manufacturers will not incur unreasonably high per unit increases in cost, and consequently should not be excluded from complying with the regulations. However, to minimize certification costs both for the manufacturers and for the government, an experimental provision for low volume manufacturers has been adopted. Manufacturers with total U.S. sales of less than 10,000 vehicles will not be required to submit vehicles for certification testing by EPA. These manufacturers will be required to affirm in writing to EPA that their motorcycles conform to the applicable standards as confirmed by emission test data generated by or for the manufacturers (and retained in the records of the manufacturer) and that the aggregate model year sales of motorcycles to be covered by the certificate of conformity will be less than 10,000. The manufacturer must also retain in his records all of the data that would otherwise be required to be submitted to EPA in the completed application for certification; this documentation need not be submitted to EPA unless specifically requested by EPA at some subsequent time.

The procedure described above reduces the number of motorcycles required to be tested by EPA by approximately 60 percent from the procedure proposed in the NPRM. This is accomplished by revised vehicle selection criteria, the combining of durability and data vehicles into one test vehicle, and the special provisions for manufacturers with less than 10,000 annual sales. The Agency recognizes that this certification procedure is new and untried, and may require modification at a future date should it fail to result in assuring that motorcycles are designed to meet the emission standards for their useful life. However, the risk of this experiment is negated by the relatively small contribution of low volume manufactured motorcycles to air pollution. Currently there are only five manufacturers who sell more than 10,000 vehicles per year in the United States. Collectively these five produce over 90 percent of all motorcycles sold in this market while approximately 27 other manufacturers produce the remainder. If a special provision were not made to preclude small volume manufacturers from full certification, EPA would have to devote almost a quarter of its motorcycle certification resources to test vehicles which account for less than 5 percent of motorcycle emissions. While the special provisions in the final rule will allow the Agency and the smaller manufacturers to realize some cost savings they in no way reduce the manufacturer's obligation to comply with such standards. Since the Agency expects to include production motorcycles made by small volume manufacturers in one or more surveillance testing programs, the desired control will be obtained.

Useful life. In the NPRM useful life was described as the average distance a motorcycle could be expected to travel in its lifetime. The definition of useful life adopted by EPA for final rule making is of considerable import to the industry for two reasons. First, the definition of useful life affects the design of vehicles capable of meeting the emission standards in the preproduction design evaluation process ("certification"). To show compliance with a given emission standard over a greater distance requires emission control equipment which either is more durable or meets lower initial targets in order to continue meeting the emission standards after deterioration has occurred. Second, the useful life definition affects the duration of the warranties and the applicability of recall provisions in section 207 of the Act. Thus, the longer the useful life, the more extensive will be the manufacturer's liability under the warranty provisions and the greater his jeopardy under the recall provisions.

EPA has believed since the initial development of this regulation that its obligation is to obtain the maximum emission reduction which the technology allows, giving appropriate consideration to the cost of compliance. Obtaining the maximum reduction could theoretically be accomplished either of two ways—by specifying a given set of emission standards with a requirement that they be met for a useful life equal to their average total lives; or by specifying a shorter useful life mileage during which the standards are applicable (if permissible under the law), while setting correspondingly more stringent emission standards. EPA chose the first option in its proposal (namely, a set of standards which appeared feasible if they had to be met for average total life), because a longer period of useful life ensures some degree of pollution control for a greater proportion of the population of motor vehicles in use at any point in time and because EPA believed its discretion to specify useful life was limited by explicit statutory guidance (as will be explained below). The option of a shorter useful life with a tighter emission standard would be more likely to lead to gross emitters in the second half of a vehicle's life, particularly for a type of vehicle for which owner maintenance is the rule rather than the exception, and would not come as close as possible to the only useful life mileage for any vehicles given in the statute. Thus EPA believes that the proposed specification of useful life distance as average total life distance was supported by either of two independent considerations: It was closest to the statutory intent and, even if the statute is read to give EPA discretion to adopt a shorter period, the longer period was preferable public policy.

The comments submitted in response to the notice of proposed rule making did not lead EPA to conclude that it was wrong on the law, or provide any data or arguments (such as cost-effectiveness comparisons or demonstrations that compliance for average total life was infeasible) leading EPA to conclude that it had chosen an undesirable policy. Therefore EPA has decided to adopt the specification of "useful life" for motorcycles as average total life distance or five years, whichever comes first. EPA is aware that the manufacturers are already devoting their programs toward meeting the proposed emission standard for the life of their vehicles.

The policy issue will be discussed first. Even those manufacturers who argued that the Administrator was legally obligated to use half life as the basis of useful life nevertheless conceded that the Administrator could choose a longer period of time if he determined it was "appropriate," under section 202(d)(2) of the Act.[1] Although he does not believe the statute requires, or even allows (see below), useful life for motorcycles to be defined as half life, the Administrator determined that he should analyze the "appropriate" useful life, in case a court should agree with the legal views of these commenters. It has been determined that for motorcycles it is appropriate to specify a useful life of average total life for several reasons.

First, shorter useful lives are a compromise with what can be done in air pollution control, since they allow vehicles to escape regulation completely once a certain point is passed.

Second, technology allows motorcycles to be designed such that their emission control features are durable for their total lives, which are in all cases

[1] These manufacturers argued that EPA has discretion to classify motorcycles as "other" motor vehicles subject to section 202(d)(2) for purposes of determining useful life. As the D.C. Circuit has emphasized, Congress, in using the term "light duty vehicle", had in mind passenger cars exclusively or almost exclusively. International Harvester Co. v. Ruckelshaus, 478 F.2d 615, 639 (D.C. Cir. 1973).

less than two fifths the mileages for which automobile manufacturers and all other regulated manufacturers must design their emission control devices and systems to properly function.

None of the major manufacturers argued that they would be unable to meet the proposed 1978 standards over the full lifetime of their vehicles. Two manufacturers stated that a few of their models have generally low durability for some components which will ultimately cause the vehicle to be inoperative and that this could lead to difficulties during certification testing if tests had to be run for the full lifetime mileage. (As will be noted later this problem has been alleviated by permitting anticipated maintenance during the durability test.) In their comments on the NPRM manufacturers told EPA that their development efforts directed towards meeting the proposed 1978 federal standards for the full lifetime of their motorcycles were already underway.

The 1980 standards initially proposed by EPA (0.25 grams/kilometre—HC, 2.1 grams/kilometre—CO, and 0.25 grams/kilometre—NOx were the equivalent values to kilometre—NOx were the equivalent values to the light duty vehicle statutory standards. Most motorcycle manufacturers claimed that this level of emission control was currently technologically infeasible for motorcycles and that sufficient lead time was not available to develop the new technologies necessary to meet these standards by 1980. As a result EPA has adjusted the 1980 standards to levels which in EPA's technical judgment can be met by manufacturers without undue hardship. Manufacturers have known about the revised 1980 standards for almost five months and have not called on EPA to halt their implementation on the grounds that they were infeasible. Further reason to believe that manufacturers can achieve at least a 5.0 gram/kilometer standard for HC emissions is based on the data supplied to the Administrator by the industry which led the Administrator to conclude in his California Waiver decision (41 FR 44209, October 7, 1976) that lead time and technology were available for manufacturers to comply with this level of stringency even though it might require two-stroke engines of greater than 250 cc displacement to convert to four-stroke engines.

Third, apart from issues of technological feasibility, the manufacturers might have offered data suggesting that for a given level of stringency in the standard the use of the total life concept was less cost-effective than use of a half life concept. But no conclusive arguments to this effect were offered for the 1978 standards which were proposed.

In summary, the Administrator has found several reasons of public policy which have led him to determine that the periods of useful life set forth in these regulations are appropriate.

EPA believes that the mileages set forth in these regulations are the required ones under section 202(d) of the Clean Air Act. Some commenters disagreed. These commenters argued not only that average total life was not required as the useful life for motorcycles under the Act, but that "half life" was. After careful consideration of the arguments and research offered by these commenters on the question, EPA has concluded that they are in error.

In section 202(d)(1) of the Act Congress specified the useful life of "light duty vehicles" as a period of 5 years or 50,000 miles (or the equivalent). For "any other motor vehicle," section 202(d)(2) requires the same or a "greater duration or mileage." Thus, whether motorcycles are light duty vehicles or "other" vehicles, the same floor of 5 years/50,000 miles appears to be the minimum allowed by the Act. Some manufacturers have suggested that the phrase "(or the equivalent)" which follows "50,000 miles" in section 202(d)(1) (and by implication in section 202(d)(2)) evidences a Congressional intent that the floor, or minimum, useful life for any vehicle is its "half life," rather than 5 years/50,000 miles.[2] While it is true that 5 years or 50,000 miles happens to equate approximately with half of the total lifetime usage of passenger cars (which are the sole, or at least major, category of light duty vehicles)[3] neither the language of the Act nor the legislative history indicates a Congressional intent that the half-life concept be applied as the minimum for other classes of vehicles, or that the words "(or the equivalent)" have that meaning.

The inclusion of the word "equivalent" in section 202(d) simply took account of the long-standing administrative policy of the Department of Health, Education, and Welfare (which regulated motor vehicle emissions prior to the creation of EPA) that the emission standards must be applicable to vehicles during the "normal service in the hands of the public" or during the test track "equivalent" of such normal service, since accumulation of mileage during certification was required to take place on a test track according to a specified urban driving cycle. See 45 CFR 85.87, 31 FR 5177 (March 30, 1966); § 85.92, 33 FR 8317 (June 4, 1968); § 85.92, 35 FR 17303 (November 10, 1970). For heavy duty vehicles, HEW required that the standards be applicable during "[n]ormal service in an urban area (or its dynamometer operation equivalent)." Proposed 45 CFR 85.113, 33 FR 126 (January 4, 1968); see §§ 85.113, 85.133, 33 FR 8319, 8322 (June 4, 1968); §§ 85.113, 85.133, 35 FR 17307, 17310, (November 10, 1970).

In sum, the origin of the phrase "(or the equivalent)" in section 202(d) of the Act was simply the administrative practice of allowing a variety of different "equivalent" methods of accumulating mileage or time to be used to prove the same things. This practice existed even prior to 1970 and the phrase has been consistently interpreted by EPA since 1970 for the same purpose.[4] The phrase was not intended by Congress to be a code word for "half life," which could have been expressed in explicit language if such had been the intention.[5] Thus the contention that there is a legal requirement for the Administrator to adopt half life as useful life is not valid.

As mentioned above, EPA believes that it is constrained by the statute from choosing a shorter period than it has done for motorcycles. In fact, EPA would have felt obligated to specify 50,000 miles if motorcycles lasted that long in actual service. Section 202(d)(1) of the Act established 5 years or 50,000 miles as the floor for useful life for light duty vehicles, and section 202(d)(2) incorporates this by reference as a floor for all other vehicles. However, it is obvious that few, if any, motorcycles last 50,000 miles (although they do last 5 years or more). This presented EPA with the choice between mandating a useful life mileage for motorcycles which is longer than the life of the vehicle (and therefore could not be met in a certificaton durability test) or selecting a useful life which comes as close as possible to the statutory floor of 50,000 miles. EPA concluded that the Congressional standard of a 50,000 mile useful life could best be met, for a vehicle which did not last 50,000 miles, by specifying a useful life as close to it as possible. Since specifying useful life as average total life distance leads to a much closer approximation of the 50,000

[2] One of the manufacturers argued that the phrase "(or the equivalent)" requires that useful life for motorcycles be the portion of a motorcycle's total life that is equivalent to the portion that 50,000 miles represents in a passenger car's total life, and stated that this was 60 percent; in other words, this comment stated that the statute required three-fifths life, rather than half life or total life. Another, which at a later stage argued that the statute required half life, had earlier argued that the phrase "(or the equivalent)" means the mileage equivalent of 5 years of use, without regard to what portion of the vehicle's total life that figure would represent. For the reasons stated in the text neither of these positions is demonstrated by the legislative history.

[3] See International Harvester Co. v. Ruckelshaus, 478 F. 2d 615, 639 (D.C. Cir. 1973); S. Rep. No. 91-1196, 91st Cong., 2d Sess. 24 (1970).

[4] After the 1970 amendments of the Act, the regulations were restructed to provide for expressing the applicability of emission standards in terms of the phrase "useful life," and the "equivalences" to normal mileage accumulation were transferred to the definitional sections of the regulation. It was not considered necessary to continue the phrase "equivalent" for light duty vehicles, but the phrase was continued for heavy duty engines, for which durability testing is normally done on an engine dynamometer, and the length of the test is defined in terms of hours instead of miles. 45 CFR 1201.1(a)(33)(ii) and (iii), 36 FR 16905 (August 26, 1971). These definitions, using the term "equivalent", are currently set forth in 40 CFR 85.702(a)(17), and 85.802(a)(26); *cf.* § 85.902 (1976).

[5] Indeed, to adopt the view that "equivalent" means "half life" would confer on the Administrator discretion to change even the five year/fifty thousand mile provision of 202(d)(1) for passenger cars if he found from new data that some other figures were "equivalent" to half life. This conclusion would be at odds with the express intent of Congress that it, not the Administrator, set the useful life for automobiles.

mile floor than would average half life distance, this becomes the mandatory floor.

As noted earlier, several manufacturers commented on the appropriateness of the specific values EPA had calculated for average lifetime mileage in the NPRM. Numerous detailed analyses of motorcycle average total life mileage based, as the EPA study was, on the Gallup Motorcycle Survey data, were received as comments to the NPRM. In calculating the useful life values contained in this final rule making, the best features of these analyses were combined with EPA's original analysis to obtain the most appropriate values, and these are used in the useful life definition contained in this final rule making. Life time mileages for three displacement classes were determined to be necessary and are as follows: 12,000 kilometres (7,456 miles) for small displacement motorcycles; 18,000 kilometres (11,185 miles) for medium displacement motorcycles; and 30,000 kilometres (18,641 miles) for large displacement motorcycles.

In the NPRM EPA did not propose a period of time to accompany mileage as a part of the useful life definition. For the certification-compliance testing section of the regulations a time period is irrelevant. For the warranty or recall provisions, however, a time period is useful to provide the manufacturer some specific limit to the period during which the vehicles must conform to applicable emission standards. Section 202(d) of the Act requires that EPA must set as useful life a period of five years or, if appropriate, some greater value. In this case EPA will set the minimum period that the law allows, or five years, as the useful life of a motorcycle. This value will apply regardless of the engine displacement of the vehicle.

Maintenance. The manufacturers requested that break-in maintenance and decarbonization be allowed as scheduled maintenance, and that combustion chamber access be allowed as unscheduled maintenance. Under the promulgated regulations, scheduled maintenance has been divided into two classes: Periodic maintenance and anticipated maintenance. Periodic maintenance will cover all those items which are required at fixed distance or time intervals, such as oil changes, tune-ups, etc. Any periodic maintenance not specifically authorized by the regulations may be performed as long as a showing is made that this maintenance will be performed by most owners in actual use. Anticipated maintenance will cover those types of failures which are likely to occur and for which no preventive maintenance is appropriate, and whose occurrence is manifested by an overt indication to the owner.

Examples of anticipated maintenance items are piston seizure which results in the vehicle being inoperative, or the need for cylinder head decarbonization, manifested by an obvious loss of power or surging. To qualify for anticipated maintenance, a manufacturer must specify in his application for certification the approximate distance at which the need for anticipated maintenance will occur, and must include the maintenance item in the owner's maintenance instructions. Anticipated maintenance must be approved by the Administrator prior to service accumulation. During testing the maintenance may be performed if there is an overt indication of the failure, and if the failure does not otherwise render the vehicle unrepresentative. Access to the combustion chamber will be allowed only if the manufacturer indicates prior to testing that such a failure is anticipated to occur and if he makes a showing that the type of maintenance which will alleviate the failure is likely to be done in the field.

Both the 207(a) warranty and the recall provision apply to motorcycles. The application of these requirements is neither affected by, nor in conflict with, the concept of anticipated maintenance. Anticipated maintenance instructions are premised on the catastrophic failure of parts to which they apply and the fact that such parts have a known service life less than the useful life of the motorcycle and must be installed and functioning in order for the motorcycle to operate. A catastrophic failure as used here is one which occurs without a significant period of degradation of either components or emissions performance. It is also a failure which renders the motorcycle inoperative. Thus, no amount of adjustment or modification would allow the motorcycle to operate.

Because of the nature of catastrophic failures, components which fail in such a manner pose no threat to the emissions performance of motorcycles. Such failures covered by anticipated maintenance instructions may not be subject to a claim under the section 207(a) warranty or recall under section 207(c)(1). However, the existence of an anticipated maintenance instruction will not insulate a manufacturer from recall or warranty actions if a component to which such an instruction applies fails in a non-catastrophic mode. If such a component actually deteriorates and emissions exceed standards (as a direct consequence of the failure or as a result of engine adjustment to improve driveability), nonconforming motorcycles may be remedied by a claim under the warranty and/or the recall provision.

Beginning with the 1980 model year, EPA will specify as part of scheduled maintenance the adjustment settings of any components which are capable of being adjusted and which would be expected to affect emission levels. Those adjustments within the physically allowable range that are expected to maximize driver perceived performance characteristics will be specified. For example, settings for the idle mixture, carburetor fuel metering rod and spark timing will be specified, where adjustment is available. Therefore, the manufacturers will be required to either calibrate the vehicle so that it meets the standards at all adjustments or to physically and permanently constrain the range of adjustment to the degree necessary so that the required emission levels will be achieved at any adjustment within that range. It is expected that motorcycle manufacturers will comply with this requirement by eliminating the need for certain in-use adjustments and by providing physical limitations (positive stops) to the range of any remaining maintenance adjustments. This procedure is being adopted because motorcycles to a large extent are maintained by their owners, and these vehicles are expected to be set by the owner to those adjustment points that he or she perceives will provide optimum performance by improving either the power or the fuel economy.

This procedure is intended to prevent the above standard emission levels otherwise associated with maladjustment. This provision of the regulations is especially important to the effective implementation of the 1980 standards since it is expected that the technology to be used to meet these standards will be basically engine adjustment technology. If limitations are not placed on such adjustments, it would be reasonably expected that the effectiveness of emission control would be largely negated as an inherent result of in-use maintenance practices.

Test Procedures. In general only minor adverse comments were received with respect to the test procedures. As stated in the NPRM preamble, consideration was being given to the use of the Critical Flow Venturi sampling system. This system has been adopted as an allowable alternative to the proposed Positive Displacement Pump constant volume sampler.

Manufacturers commented that the pre-emission test soak period was unnecessarily long especially for the small displacement motorcycles. Based on manufacturer and EPA data, the soak period has been revised to require soak periods of 6, 8 and 12 hours for Classes I through III, respectively.

Opposition to the 12 hour cyclic accumulation of durability distance was stated by some manufacturers. It was their opinion that this procedure added substantial cost and delay to distance accumulation and the effect on durability was uncertain. EPA maintains that this procedure is relevant to durability test cycles, and considers its use appropriate. The Agency concluded that the non-operating period should be reduced to 8 hours in order to minimize distance accumulation time while still achieving the objectives of the procedure. Since the time required to accumulate the specified distances is 9 to 22 days, depending on the class, this requirement is not considered unreasonable.

The emission test dynamometer requirements have been restricted to performance requirements in terms of the road load characteristics and cooling. This was done to allow the maximum amount of test equipment flexibility for motorcycle manufacturers. The road load requirements have been changed from the single velocity specification to a two term equation of simulated road force as a function of velocity. The specified road load force at 65 km/h must be simulated

within a 5 newton (1.1 pounds force) tolerance. The forces at other speeds are simulated to the best ability of the equipment being used. It is the Agency's intention to specify a force tolerance over the entire test speed range if tests indicate there are significant errors in emissions or fuel economy measurement resulting from the use of equipment which does not accurately simulate the specified road load. These tests will be performed after the dynamometer being procured by EPA becomes operational; and tolerances, if determined necessary, will be issued for the 1980 model year.

One manufacturer was opposed to the emission driving schedule because of the need for the very small motorcycles to operate at wide open throttle during part of the driving schedule. The required maximum speed of 59 km/h (37 mi/h) for urban driving is considered by EPA to be a representative top speed for nonfreeway traffic. EPA tests revealed that only motorcycles with certain combinations of gearing and wheel size have difficulty achieving the maximum speed. The present procedure which allows wide open throttle operation in place of achieving the required speed is considered representative of actual use, therefore the driving schedule as proposed is specified.

Manufacturers commented that the speeds in the durability cycle were also not representative for certain motorcycles. An analysis of the durability driving schedule speeds determined that certain modifications to the lap speeds should be made. The final rule making reflects these revised speeds.

Based on comments by one manufacturer, the displacement applicability of the two sets of shift points has been changed from above and below 170 cc to above and below 280 cc. A requirement for downshifting at the same vehicle speed as the upshift has been added. The use of manufacturer's recommended shift procedures is still allowable.

Motorcycle manufacturers have requested the use of indoor dynamometers for distance accumulation. There are no specific provisions for this in the regulations. However, the EPA will not disallow the use of a chassis dynamometer solely because it is located within a building. Indoor ambient temperature and the temperature measured at the cooling fan that are within 5° C of outdoor ambient are considered reasonable. Manufacturers wishing to use an indoor chassis dynamometer must request this in their application for certification.

Comments which were received in response to the NPRM are available for inspection and copying during normal business hours at the U.S. Environmental Protection Agency, Public Information Reference Unit, Room 2922 (EPA Library), 401 M St. S.W., Washington, D.C. 20460. As provided for in 40 CFR Part 2, a reasonable fee may be charged for copying services.

Single copies of EPA's detailed analysis of the comments received, entitled "Motorcycle Emission Regulations—Summary and Analysis of NPRM Comments", as well as copies of the Final Environmental Impact Statement are available upon request from the Public Information Center (PM-215), U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460.

This Notice of Final Rulemaking is issued under the authority of sections 202, 206, 208 and 301(a) of the Clean Air Act, as amended (42 U.S.C. 1857f-1, 1857f-5, 1857f-6, 1857g(a)).

Effective date: This regulation becomes effective on February 4, 1977.

NOTE.—The Environmental Protection Agency has determined that this document contains a major regulation requiring preparation of an Inflation Impact Statement under Executive Order 11821 and OMB Circular A-107 and certifies that an Inflation Impact Statement has been prepared.

Dated: December 23, 1976.

JOHN QUARLES,
Acting Administrator.

Subparts E and F are added as follows:

Subpart E—Emission Regulations for 1978 and Later New Motorcycles, General Provisions

Sec.

86.401-78 General applicability.
86.402-78 Definitions.
86.403-78 Abbreviations.
86.404-78 Section numbering.
86.405-78 Measurement system.
86.406-78 Introduction, structure of subpart, further information.
86.407-78 Certificate of conformity required.
86.408-78 General standards; increase in emissions unsafe conditions.
86.409-78 Defeat devices, prohibition.
86.410-78 Emission standards for 1978 motorcycles.
86.410-80 Emission standards for 1980 motorcycles.
86.411-78 Maintenance instructions, vehicle purchaser.
86.412-78 Maintenance instructions, submission to Administrator.
86.413-78 Labeling.
86.414-78 Submission of vehicle identification numbers.
86.415-78 Production vehicles.
86.416-78 Application for certification.
86.417-78 Approval of application for certification.
86.418-78 Test fleet selection.
86.419-78 Engine displacement, motorcycle classes.
86.420-78 Engine families.
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AUTHORITY: Secs. 202, 206, 207, 208, and 301(a) of the Clean Air Act, as amended (42 U.S.C. 1857f-1, 1857f-5, 1857f-5g, 1857f-6, 1857g(a)).

Subpart E—Emission Regulations for 1978 and Later New Motorcycles, General Provisions

§ 86.401-78 General applicability.

(a) This subpart applies to 1978 and later model year, new gasoline-fueled motorcycles built after 31 December 1977.

(b) Motocycles with engine displacements less than 50 cc (3.1 cu. in.) are excluded from the requirements of this subpart.

(c) A motorcycle is excluded from the requirements of this subpart, if, with an 80 kg (176 lb) driver, it cannot:

(1) Start from a dead stop using only the engine, or

(2) Exceed a maximum speed of 40 km/h (24.9 mph) level paved surfaces.

§ 86.402–78 Definitions.

(a) The definitions in this section apply to this subpart and also to Subpart F.

"Act" means Part A of title II of the Clean Air Act, 42 U.S.C. 1857 f–1 through f–7, as amended by Pub. L. 91–604.

"Administrator" means the Administrator of the Environmental Protection Agency or his authorized representative.

"Class", see § 86.419.

"Crankcase emissions" means airborne substances emitted to the atmosphere from any portion of the engine crankcase ventilation or lubrication systems.

"Curb mass" means the actual or manufacturer's estimated mass of the vehicle with fluids at nominal capacity and with all equipment specified by the Administrator.

"Displacement", and "Displacement Class", see § 86.419.

"Engine family" means the basic classification unit of a manufacturer's product line used for the purpose of test fleet selection and determined in accordance with § 86.420.

"Engine-displacement-system combination" means an engine family-displacement-emission control system combination.

"EPA Enforcement Officer" means any officer or employee of the Environmental Protection Agency so designated in writing by the Administrator (or by his designee).

"Exhaust emissions" means substances emitted to the atmosphere from any opening downstream from the exhaust port of a motor vehicle engine.

"Fuel system" means the combination of fuel tank, fuel pump, fuel lines, oil injection metering system, and carburetor or fuel injection components, and includes all fuel system vents.

"Loaded vehicle mass" means curb mass plus 80 kg (176 lb.), average driver mass.

"Model year" means the manufacturer's annual production period (as determined by the Administrator) which includes January first of such calendar year. If the manufacturer has no annual production period, the term "model year" shall mean the calendar year.

"Motorcycle" means any motor vehicle with a headlight, taillight, and stoplight and having: Two wheels, or Three wheels and a curb mass less than or equal to 680 kilograms (1499 pounds).

"Oxides of nitrogen" means the sum of the nitric oxide and nitrogen dioxide contained in a gas sample as if the nitric oxide were in the form of nitrogen dioxide.

"Scheduled maintenance" means any adjustment, repair, removal, disassembly, cleaning, or replacement of vehicle components or systems which is performed on a periodic basis to prevent part failure or vehicle malfunction, or anticipated as necessary to correct an overt indication of vehicle malfunction or failure for which periodic maintenance is not appropriate.

"Span gas" means a gas of known concentration which is used routinely to set the output level of any analyzer.

"System" includes any motor vehicle modification which controls or causes the reduction of substances emitted from motor vehicles.

"Useful life" is defined for each class (see § 86.419) of motorcycle:

Class I–5.0 years or 12,000 km (7,456 miles), whichever first occurs.

Class II—5.0 years or 18,000 km (11,185 miles), whichever first occurs.

Class III—5.0 years or 30,000 km (18,641 miles), whichever first occurs.

"Unscheduled maintenance" means any inspection, adjustment, repair, removal, disassembly, cleaning, or replacement of vehicle components or systems which is performed to correct or diagnose a part failure or vehicle malfunction which was not anticipated.

"Zero (0) kilometers (miles)" means that point after initial engine starting at which normal assembly line operations and adjustments are completed.

§ 86.403–78 Abbreviations.

The abbreviations used in this subpart have the following meanings in both capital and lowercase:

ASTM—American Society for Testing and Materials.
C—Celsius.
cc—Cubic centimetre(s).
cfh—Cubic feet per hour.
cfm—Cubic feet per minute.
cm—Centimetre(s).
CO—Carbon monoxide.
CO_2—Carbon dioxide.
Conc—Concentration.
cu.—Cubic.
CVS—Constant volume sampler.
EGR—Exhaust gas recirculation.
EP—End point.
EPA—Environmental Protection Agency.
F—Fahrenheit.
h—hour.
HC—Hydrocarbon(s).
Hg—Mercury.
H_2O—Water.
in.—Inch(es).
K—Kelvin.
kg—Kilogram(s).
km—Kilometre(s).
kpa—Kilopascals.
lb—Pound(s).
m—Metre(s).
mph—Miles per hour.
mm—Millimetre(s).
N_2—Nitrogen.
NOx—Oxides of nitrogen.
No.—Number.
O_2—Oxygen.
Pa—Pascal(s).
Pb—lead.
ppm—Parts per million by volume.
psi—Pounds per square inch.
psig—Pounds per square inch gauge.
R—Rankine.
rpm—Revolutions per minute.
wt—Weight.
°—Degree(s).
%—Percent.

§ 86.404–78 Section numbering.

(a) The year of initial applicability of a section is indicated by its section number. The two digits following the hyphen designate the first model year for which a section is effective. A section remains effective until superseded.

Example. Section 86.411–78 applies to 1978 and subsequent model years until it is superseded. If a § 86.411–81 is promulgated it would take effect beginning with 1981; § 86.411–78 would apply to years 1978 through 1980.

(b) A reference to a section without a year designation implies the appropriate model year.

Example. When considering 1979 vehicles a reference to § 86.411 implies § 86.411–79. However if no § 86.411–79 has been promulgated then § 86.411–78 is implied; See paragraph (a) of this section.

§ 86.405–78 Measurement system.

(a) This subpart and Subpart F have been written using System International (SI) units. SI units will be used to determine compliance with these regulations. English equivalents have been indicated solely for the user's convenience.

§ 86.406–78 Introduction, structure of subpart, further information.

(a) This subpart contains general provisions regulating the emission of air pollution from new motorcycles. Test procedures are found in Subpart F.

(b) Several discrete concepts are addressed:

(1) *Requirements.* §§ 86.407 to 86.415.

(2) *Application for certification.* §§ 86.416 and 86.417.

(3) *Test fleet selection.* § § 86.418 to 86.423.

(4) *Service accumulation, testing, maintenance, certification.* §§ 86.424 to 86.439.

(5) *Administrative provisions.* §§ 86.440 to 86.444.

(c) The certification procedure to be followed depends upon the manufacturer's projected sales.

(1) New motorcycles, produced by a manufacturer whose projected U.S. sales of motorcycles is 10,000 or more units (for the model year in which certification is sought) shall demonstrate compliance with all general standards and all specific emission requirements before they can be sold in the United States. The manufacturer is required to submit an application with sales data, product information, required maintenance, testing and service accumulation procedures. The Administrator will select vehicle(s) which will represent the manufacturer's product line. The manufacturer is required to construct these vehicles to be representative of actual production. Service is accumulated and emission tests performed with data submitted to the Administrator. The Administrator may run his own tests to confirm the manufacturer's results. The Administrator will review the data and either grant or deny certification. If the manufacturer wishes to make changes to a certified vehicle, or to produce a new vehicle, the Administrator must be notified. The Administrator may require testing to demonstrate continued compliance with emission standards. Each vehicle must be labeled with tune up specifications

and the purchaser must be supplied with maintenance instructions. Also, information on production vehicles must be supplied to the Administrator.

(2) New motorcycles produced by a manufacturer whose projected U.S. sales of motorcycles is less than 10,000 units (for the model year in which certification is sought) shall meet both the general standards and specific emission requirements described in § 86.401 through § 86.417, § 86.425, § 86.437, and § 86.440 through § 86.444 of this subpart before they can be sold in the United States. The manufacturer is required to submit an application containing a statement that his vehicles conform to the applicable emission standards. The manufacturer is required to retain in his records, but not submit with the application, valid emission test data which support his statement. The Administrator will review the application and either grant or deny certification. Each vehicle must be labeled with tune up specifications and the purchaser must be supplied with maintenance instructions. Also, information on production vehicles must be supplied to the Administrator.

(d) Manufacturers who are considering an application should contact: Director, Certification Division, Environmental Protection Agency, 2565 Plymouth Rd., Ann Arbor, Michigan 48105 and state whether he plans to certify for total sales of greater than or less than 10,000 vehicles for the applicable model year.

§ 86.407–78 Certificate of conformity required.

Every new motorcycle manufactured for sale, sold, offered for sale, introduced or delivered for introduction into commerce, or imported into the United States which is subject to any of the standards prescribed in this subpart is required to be covered by a certificate of conformity issued pursuant to this subpart.

§ 86.408–78 General standards; increase in emissions; unsafe conditions.

(a) Any system installed on or incorporated in a new motorcycle to enable such vehicle to conform to standards imposed by this subpart:

(1) Shall not in its operation or function cause the emission into the ambient air of any noxious or toxic substance that would not be emitted in the operation of such vehicle without such system, except as specifically permitted by regulation; and

(2) Shall not in its operation, function, or malfunction result in any unsafe condition endangering the motorcycle, its rider(s), or persons or property in close proximity to the vehicle.

(b) Every manufacturer of new motorcycles subject to any of the standards imposed by this subpart shall, prior to taking any of the actions specified in section 203(a)(1) of the Act, test or cause to be tested motorcycles in accordance with good engineering practice to ascertain that such test vehicles will meet the requirements of this section for the useful life of the vehicle.

§ 86.409–78 Defeat devices, prohibition.

(a) No motorcycle shall be equipped with a defeat device.

(b) Defeat device means any element of design which:

(1) Senses temperature, vehicle speed, engine RPM, transmission gear, manifold vacuum, or any other parameter for the purpose of activating, modulating, delaying or deactivating the operation of any part of the emission control system and

(2) Reduces the effectiveness of the emission control system under conditions which may reasonably be expected to be encountered in normal urban vehicle operation and use, unless

(i) Such conditions are substantially included in the Federal emission test procedure, or

(ii) The need for the device is justified in terms of protecting the vehicle against damage or accident, or

(iii) The device does not go beyond the requirements of engine starting or warm-up.

§ 86.410–78 Emission standards for 1978 motorcycles.

(a)(1) Exhaust emissions from 1978 model year motorcycles shall not exceed:

(i) *Hydrocarbons.* (A) For vehicles with engine displacements equal to or greater than 50 cc (3.1 cu. in.) but less than 170 cc (10.4 cu. in.), 5.0 grams per vehicle kilometre.

(B) For vehicles with engine displacements equal to or greater than 170 cc (10.4 cu. in.) but less than 750 cc (45.8 cu. in.), the standard is computed by use of the following formula, rounded in accordance with ASTM E 29–67 to two significant figures:

Hydrocarbon standard in grams per vehicle kilometre=5.0+0.0155×(D–170).
where:
D = engine displacement of the motorcycle in cubic centimetres, see § 86.419.

(C) For vehicles with engine displacements equal to or greater than 750 cc (45.8 cu. in.), 14 grams per vehicle kilometre.

(ii) *Carbon monoxide*: 17 grams per vehicle kilometre.

(2) The standards set forth in paragraph (a)(1) of this section refer to the exhaust emitted over driving schedules as set forth in Subpart F and measured and calculated in accordance with those procedures.

(b) No crankcase emissions shall be discharged into the ambient atmosphere from any new motorcycle subject to this subpart.

§ 86.410–80 Emission standards for 1980 motorcycles.

(a)(1) Exhaust emissions from 1980 model year motorcycles shall not exceed:

(i) *Hydrocarbons.* 5.0 grams per vehicle kilometre.

(ii) *Carbon monoxide.* 12 grams per vehicle kilometre.

(2) The standards set forth in paragraph (a)(1) of this section refer to the exhaust emitted over driving schedules as set forth in Subpart F and measured and calculated in accordance with those procedures.

(b) No crankcase emissions shall be discharged into the ambient atmosphere from any new motorcycle subject to this subpart.

§ 86.411–78 Maintenance instructions, vehicle purchaser.

(a) The manufacturer shall furnish or cause to be furnished to the ultimate purchaser of each new motorcycle the written instructions for the periodic and anticipated maintenance and use of the vehicle by the ultimate purchaser as may be reasonable and necessary to assure the proper functioning of emission control systems for the vehicle's useful life.

(1) Such instructions shall be provided for those vehicle and engine components listed in Appendix VI to this part (and for any other components) to the extent that maintenance of these components is necessary to assure the proper functioning of emission control systems.

(2) Such instructions shall be in the English language and in clear, and to the extent practicable, nontechnical language.

(b) The maintenance instructions required by this section shall:

(1) Contain a general description of the documentation which the manufacturer will require from the ultimate purchaser or any subsequent purchaser as evidence of compliance with the instructions, and

(2) Specify the performance of all scheduled maintenance performed by the manufacturer under § 86.428.

§ 86.412–78 Maintenance instructions, submission to Administrator.

(a) *Instructions for ultimate purchaser.* (1) The manufacturer shall provide to the Administrator, at least 30 days before being supplied to the ultimate purchaser (unless the Administrator consents to a lesser period of time), a copy of the maintenance instructions which the manufacturer proposes to supply to the ultimate purchaser. The instructions must include the periodic and anticipated maintenance contained in the application for certification or contained in the manufacturers' records (if anticipated sales are less than 10,000 units). Such instructions must be reasonable and necessary to assure the proper functioning of the vehicle's emission control systems.

(2) Any revision to the maintenance instructions which will affect emissions shall be supplied to the Administrator at least 30 days before being supplied to the ultimate purchaser unless the Administrator consents to a lesser period of time.

(b) *Other instructions.* The manufacturer of any new motorcycle subject to any of the standards prescribed in this subpart shall submit to the Administrator at the time of issuance by the manufacturer, copies of all sales brochures, instructions, or explanations regarding the use, repair, adjustment, maintenance, or testing of such vehicle relevant to the control of crankcase or exhaust emissions, issued by the manufacturer for use by other manufacturers, assembly plants,

distributors, dealers, repair facilities, and ultimate purchasers. Any material not translated into the English language need not be submitted unless specifically requested by the Administrator.

§ 86.413–78 Labeling.

(a)(1) The manufacturer of any motorcycle shall, at the time of manufacture, affix a permanent, legible label, of the type and in the manner described below, containing the information hereinafter provided, to all production models of such vehicles available for sale to the public and covered by a certificate of conformity.

(2) A plastic or metal label shall be welded, riveted, or otherwise permanently attached and must be readily accessible. Multi-part labels may be used.

(3) The label shall be affixed by the vehicle manufacturer who has been issued the certificate of conformity for such vehicle, in such a manner that it cannot be removed without destroying or defacing the label.

(4) The label shall contain the following information lettered in the English language in block letters and numerals, which shall be of a color that contrasts with the background of the label:

(i) *The label heading.* Vehicle Emission Control Information;

(ii) Full corporate name and trademark of the manufacturer;

(iii) Engine displacement (in cubic centimetres) and engine family identification;

(iv) Engine tune up specifications and adjustments, as recommended by the manufacturer, including idle speed, ignition timing, and the idle air-fuel mixture setting procedure and value (e.g., idle CO, idle air-fuel ratio, idle speed drop). These specifications shall indicate the proper transmission position during tune up;

(v) Any specific fuel or engine lubricant requirements (e.g., lead content, Research octane number, engine lubricant type);

(vi) An unconditional statement of conformity to USEPA regulations which includes the model year; for example, This Vehicle Conforms to USEPA Regulation Applicable to ——— Model Year New Motorcycles.

(b) The provisions of this section shall not prevent a manufacturer from also reciting on the label that such vehicle conforms to any other applicable Federal or State standards for new motorcycles or any other information that such manufacturer deems necessary for, or useful to, the proper operation and satisfactory maintenance of the vehicle.

§ 86.414–78 Submission of vehicle identification numbers.

(a) Upon request by the Administrator, the manufacturer of any motorcycle covered by a certificate of conformity shall, within 30 days, identify by vehicle identification number, the vehicle(s) covered by the certificate of conformity.

(b) The manufacturer of any motorcycle covered by a certificate of conformity shall furnish to the Administrator, at the beginning of each model year, any vehicle identification number coding system which identifies whether such vehicle(s) are covered by a certificate of conformity.

§ 86.415–78 Production vehicles.

(a) Any manufacturer obtaining certification shall supply to the Administrator, upon his request, a reasonable number of production vehicles selected by the Administrator which are representative of the engines, emission control systems, fuel systems, and transmissions offered and typical of production models available for sale under the certificate. These vehicles shall be supplied for testing at such time and place and for such reasonable periods as the Administrator may require.

(b) Any manufacturer obtaining certification shall notify the Administrator, on a quarterly basis, of the number of vehicles of each engine family-engine displacement-emission control system-fuel system-transmission type-inertial mass category combination produced for sale in the United States during the preceding quarter.

(c) All motorcycles covered by a certificate of conformity shall prior to delivery to the ultimate purchaser be adjusted, by the manufacturer or his agent, to the ignition timing specification detailed in § 86.413.

§ 86.416–78 Application for certification.

(a) New motorcycles produced by a manufacturer whose projected sales in the United States is 10,000 or more units (for the model year in which certification is sought) are covered by the following:

(1) An application for a certificate of conformity to the regulations in the English language applicable to new motorcycles shall be made to the Administrator by the manufacturer and shall be updated and corrected by amendment. Where possible, a manufacturer should include in a single application for certification, a description of all vehicles in each class for which certification is required. A manufacturer may, however, choose to apply separately for certification of part of his product line. The selection of test vehicles and the computation of test results will be determined separately for each application.

(2) The application shall be in writing, signed by an authorized representative of the manufacturer, and shall include the following:

(i) Identification and description of the vehicles covered by the application and a description of their engine, emission control system and fuel system components. This shall include a detailed description of each auxiliary emission control device. Transmission gear ratios, overall drive ratios and vehicle mass (or range of mass) shall also be included. The label and its location shall be specified, § 86.413. Available optional equipment shall be described.

(ii) The range of available fuel and ignition system adjustments.

(iii) Projected U.S. sales data sufficient to enable the Administrator to select a test fleet representative of the vehicles for which certification is requested. If reduced testing based on low sales volume is requested the method of predicting sales shall be described.

(iv) A description of the test equipment (if applicable) and fuel and engine lubricant proposed to be used.

(v) A description of the proposed service accumulation procedure and a description of the proposed scheduled maintenance.

(vi) A statement of recommended periodic and anticipated maintenance and procedures necessary to assure that the vehicles covered by a certificate of conformity in operation conform to the regulations, listings of the fuels and lubricants to be recommended to the ultimate purchaser and a description of the program for training of personnel for such maintenance, and the equipment required to perform this maintenance.

(vii) A description of normal assembly line operations and adjustments if such procedures exceed 10 km (6.2 miles) or one hour of engine operation.

(3) Completed copies of the application and of any amendments thereto, and all notifications under §§ 86.438 and 86.439 shall be submitted in such multiple copies as the Administrator may require.

(4) For purposes of this section, "auxiliary emission control device" means any element of design which senses temperature, vehicle speed, engine RPM, transmission gear, manifold vacuum, or any other parameter for the purpose of activating, modulating, delaying, or deactivating the operation of any part of the emission control system.

(b) New motorcycles produced by a manufacturer whose projected sales in the United States is less than 10,000 units (for the model year in which certification is sought) are covered by the following:

(1) All the information that would otherwise be required to be submitted to EPA under paragraph (a)(2) of this section must be made a part of the manufacturer's records, except there is no requirement to submit the information to the Administrator or receive approval from the Administrator.

(2) Section 86.437 details the statements that these manufacturers are required to provide to the Administrator.

(c) For the purpose of determining applicability of paragraphs (a) or (b) of this section, where there is more than one importer or distributor of vehicles manufactured by the same person, the projected sales shall be the aggregate of the projected sales of those vehicles by such importers or distributors.

§ 86.417–78 Approval of application for certification.

(a) After a review of the application for certification and any other information which the Administrator may require, the Administrator may approve

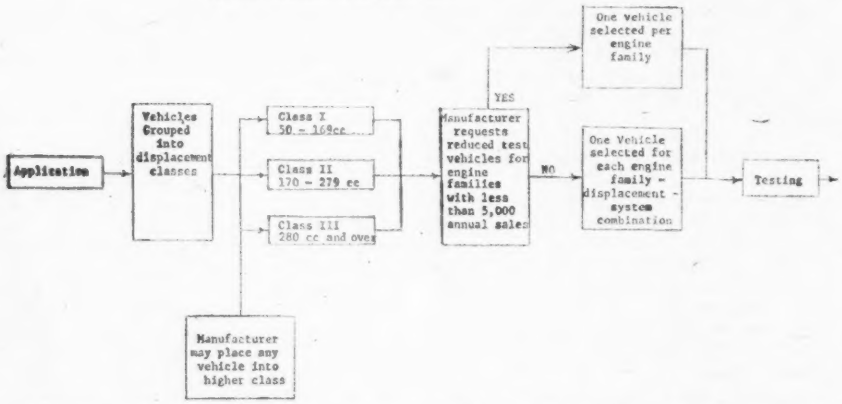
the application and select a test fleet as appropriate.

(b) The Administrator may disapprove in whole or in part an application for certification for reasons including incompleteness, inaccuracy, inappropriate proposed distance accumulation procedures, maintenance, test equipment, label content or location, fuel or lubricant, and incorporation of defeat devices in vehicles described by the application. Where any part of an application is rejected, the Administrator shall notify the manufacturer in writing and set forth the reasons for such rejection. The manufacturer may request a hearing under § 86.443.

§ 86.418–78 Test fleet selection.

(a) Test fleet selection and requirements on test vehicles are found in §§ 86.419 to 86.423. This selection process is also graphically depicted in Figure E78–1.

Figure E78-1 Selection Process


Application
Vehicles Grouped into displacement classes
Class I 50 - 169cc
Class II 170 - 279 cc
Class III 280 cc and over
Manufacturer may place any vehicle into higher class
Manufacturer requests reduced test vehicles for engine families with less than 5,000 annual sales
YES
NO
One vehicle selected per engine family
One Vehicle selected for each engine family - displacement - system combination
Testing

§ 86.419–78 Engine displacement, motorcycle classes.

(a)(1) Engine displacement shall be calculated using nominal engine values and rounded to the nearest whole cubic centimetre, in accordance with ASTM E 29–67.

(2) For rotary engines, displacement means the maximum volume of a combustion chamber between two rotor tip seals minus the minimum volume of that combustion chamber between those two rotor tip seals times three times the number of rotors.

cc = (max. chamber volume − min. chamber volume) × 3 × no. of rotors

(b) Motorcycles will be divided into classes based on engine displacement.

(1) Class I—50 to 169 cc (3.1 to 10.4 cu. in.).

(2) Class II—170 to 279 cc (10.4 to 17.1 cu. in.).

(3) Class III—280 cc and over (17.1 cu. in. and over).

(c) At the manufacturer's option, a vehicle described in an application for certification may be placed in a higher class (larger displacement). All procedures for the higher class must then be complied with, compliance with emission standards will be determined on the basis of engine displacement.

§ 86.420–78 Engine families.

(a) The vehicles covered in the application will be divided into groupings whose engines are expected to have similar emission characteristics throughout their useful life. Each group of engines with similar emission characteristics shall be defined as a separate engine family.

(b) *Reciprocating families.* To be classed in the same engine family, reciprocating engines must be identical in all of the following applicable respects:

(1) The combustion cycle.

(2) The cooling mechanism.

(3) The cylinder configuration (inline, vee, opposed, bore spacings, etc.).

(4) The number of cylinders.

(5) The engine displacement class, § 86.419.

(6) The method of air aspiration.

(7) The number of catalytic converters, location, volume, and composition.

(8) The thermal reactor characteristics.

(9) The number of carburetors.

(10) The prechamber characteristics.

(11) The number of tune ups to be performed during service accumulation.

(c) At the manufacturer's option, reciprocating engines identical in all the respects listed in paragraph (b) of this section may be further divided into different engine families if the Administrator determines that they may be expected to have different emission characteristics. This determination will be based upon a consideration of features such as:

(1) The bore and stroke.

(2) The combustion chamber configuration.

(3) The intake and exhaust timing method of actuation (poppet valve, reed valve, rotary valve, etc.).

(4) The intake and exhaust valve or port sizes, as applicable.

(5) The fuel system.

(6) The exhaust system.

(d) *Rotary families.* To be classed in the same engine family, rotary combustion cycle engines must be identical in all of the following applicable respects:

(1) The major axis of the epitrochoidal curve.

(2) The minor axis of the epitrochoidal curve.

(3) The generating radius of the epitrochoidal curve.

(4) The cooling mechanism.

(5) The number of rotors.

(6) The engine displacement class, § 86.419.

(7) The method of air aspiration.

(8) The number of catalytic converters, location, volume and composition.

(9) The thermal reactor characteristics.

(10) The number of carburetors.

(11) The prechamber characteristics.

(12) The number of tune ups to be performed during service accumulation.

(e) At the manufacturer's option, rotary combustion cycle engines identical in all the respects listed in paragraph (d) of this section, may be further divided into different engine families if the Administrator determines that they may be expected to have different emission characteristics. This determination will be based upon a consideration of features, such as:

(1) The width of the rotor housing.

(2) The type and location of intake port (side, peripheral, combination, etc.).

(3) The number of spark plugs per rotor.

(4) The fuel system.

(5) The exhaust system.

(f) Where engines are of a type which cannot be divided into engine families based upon the criteria listed in paragraphs (b) and (d) of this section, the Administrator will establish families of those engines based upon the features most related to their emission characteristics.

§ 86.421–78 Test fleet.

(a) A test vehicle will be selected by the Administrator to represent each engine-displacement-system combination. The configuration (engine calibration, transmission, drive ratio, mass, options, etc.) in the manufacturer's application which the Administrator believes has the greatest probability of exceeding the standards will be selected.

(b) At the manufacturer's option, the Administrator will only select one vehicle to represent each engine family where the total projected annual sales for that family are less than 5,000 vehicles.

(c) A manufacturer may elect to operate and test additional vehicles which are identical to those selected by the Administrator. Written notice of a commitment to operate and test additional vehicles shall be given to the Administrator prior to the start of testing and not later than 30 days following notification of the test fleet selection. The results of tests performed by the manufacturer will be combined to determine deterioration factors. Each vehicle must meet applicable standards when tested by the Administrator and when those results are projected to the useful life.

(d) In lieu of testing a test vehicle and submitting data therefore, a manufacturer may, with the prior written ap-

proval of the Administrator, submit exhaust emission data on a similar vehicle for which certification has previously been obtained or for which all applicable data has previously been submitted.

§ 86.422–78 Administrator's fleet.

The Administrator may require additional test vehicles identical in all material respects to vehicles selected in accordance with § 86.421. The number of vehicles selected shall not increase the size of the test fleet by more than 20 percent or one vehicle, whichever is greater.

§ 86.423–78 Test vehicles.

(a) At zero kilometres before testing or beginning to accumulate service on the test vehicle, the manufacturer shall provide the zero kilometre documents as required by the Administrator, and make the vehicle available for such testing or inspection as the Administrator may require. Testing or service accumulation shall not begin until authorized by the Administrator. Failure to comply with these requirements will invalidate all test data submitted for the vehicle.

(b) Once a manufacturer begins to operate a test vehicle, as indicated by compliance with paragraph (a) of this section, the data from the vehicle will be used, unless specified otherwise by the Administrator. Discontinuation of a vehicle shall be allowed only with the written consent of the Administrator.

(c) Test vehicles shall be calibrated at zero kilometres within the production tolerences applicable to the manufacturer's specifications.

(d) The Administrator may disqualify a vehicle which receives assembly line operations and adjustments which will not be performed on production vehicles.

§ 86.424–78 Service accumulation, testing and maintenance.

(a) Service accumulation, emission testing and maintenance are described in §§ 86.425 to 86.429. The testing and certification procedures are graphically depicted in Figure E78–2.

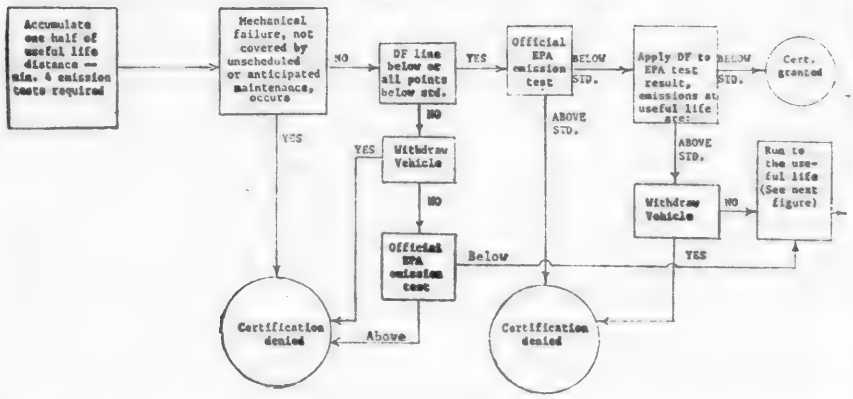


Figure E78–2 Testing and Certification

§ 86.425–78 Test procedures.

(a) Motorcycle emission test procedures are found in Subpart F.

(b) The Administrator may prescribe emission test procedures for any motorcycle which he determines is not susceptible to satisfactory testing by the procedures set forth in Subpart F.

(c) Testing of any type with respect to any test vehicle other than that specified in this subpart and Subpart F is not allowed except as specifically authorized by the Administrator.

§ 86.426–78 Service accumulation.

(a) The procedure for service accumulation will be the Durability Driving Schedule as specified in Appendix IV to this Part. A modified procedure may also be used if approved in advance by the Administrator. Except with the advance approval of the Administrator, all vehicles will accumulate distance at a measured curb mass which is within 5 kg (11.0 lb) of the curb mass specified by the Administrator.

(b) During service accumulation, vehicles shall not be operated for more than 12 hours during an operating sequence. Engine shutdowns are permitted during the operating sequence, but the periods of shutdown are not included in the 12 hour total. Following each operating sequence, the vehicle shall soak, without operation, for a minimum of 8 hours. During soak periods, the vehicle shall be exposed to normal outside ambient temperatures and humidity conditions unless vehicle maintenance or servicing is being performed.

§ 86.427–78 Emission tests.

(a) Each test vehicle shall be driven with all emission control systems installed and operating for the following total test distances, or for such lesser distance as the Administrator may agree to as meeting the objectives of this procedure. (See § 86.419 for class explanation).

Displacement class	Total test distance (kilometers)	Minimum test distance (kilometers)	Minimum number of tests
I	6,000	2,500	4
II	9,000	2,500	4
III	15,000	3,500	4

(b) All vehicles shall undergo at least four emission tests; one at the minimum test distance, one before and one after periodic maintenance, and one at the total test distance. If no maintenance is scheduled, then at least two tests will be performed, at equal intervals, between the minimum and total test distances. Additional tests may be performed; such tests must be at equal intervals and approved by the Administrator prior to starting service accumulation.

(c) Where the Administrator agrees to a lesser distance for service accumulation, he may modify the maintenance provisions of this Subpart.

(d) All tests required by this subpart must be conducted at an accumulated distance within 250 kilometers (155 mi) of the nominal distance at each test point.

(e) Up to three valid tests may be conducted at each test point. The number of valid tests must be the same at each test point for a given vehicle.

(f) The Administrator may require that any one or more of the test vehicles be submitted to him, at such places as he may designate, for the purpose of conducting emissions tests. The Administrator may specify that he will conduct such testing at the manufacturer's facility, in which case instrumentation and equipment specified by the Administrator shall be made available by the manufacturer for test operations. Any testing conducted at a manufacturer's facility pursuant to this paragraph shall be scheduled by the manufacturer as promptly as possible.

(g) Whenever the Administrator conducts a test on a test vehicle, the results of that test, unless subsequently invalidated by the Administrator, shall comprise the data for the vehicle at that prescribed test point and the manufacturer's data for that prescribed test point shall not be used in determining compliance with emission standards.

§ 86.428–78 Maintenance, scheduled; test vehicles.

(a) Periodic maintenance on the engine, emission control system, and fuel system of test vehicles shall be scheduled for performance at the same distance intervals that will be specified in the manufacturer's maintenance instructions furnished to the ultimate purchaser. Such maintenance shall be performed only under the following provisions.

(b) Periodic major engine tune-ups to the manufacturer's specifications may be performed no more frequently than as follows nor may any tune-up be performed within 1000 km prior to the total test distance.

Displacement class:	*Minimum interval (kilometers)*
I	3,000
II	3,000
III	4,000

(c) A scheduled major engine tune up shall be restricted to items listed below and shall be conducted in a manner consistent with service instructions and

specifications provided by the manufacturer for use by customer service personnel. The following items may be inspected, replaced, cleaned, adjusted, and/or serviced as required: (1) Breaker points, timing, (2) idle speed and idle air/fuel mixture, (3) valve lash, (4) engine bolt torque, and (5) spark plugs.

(d) [Reserved]

(e) Periodic change of engine and transmission oil, and change or service of oil, air, and fuel filters will be allowed at the same distance intervals that will be specified in the manufacturer's maintenance instructions.

(f) Requests for authorization of periodic maintenance of emission control related components not specifically authorized to be maintained by this section, and for anticipated maintenance (see § 86.428), must be made prior to the beginning of distance accumulation. The Administrator will approve the performance of such maintenance in the manufacturer makes a satisfactory showing that the maintenance will be performed on vehicles in use and that the maintenance is reasonable and necessary.

(1) The EGR system may be serviced a maximum of two times during the durability service accumulation if failure of the EGR system activates an audible and/or visual signal approved by the Administrator which alerts the vehicle operator to the need for EGR system maintenance, or if the need for periodic maintenance of the EGR system is overtly signalled to the vehicle operator by an appropriate means, e.g., an indicator light or significantly reduced driveability performance.

(2) The catalytic converter may be serviced only once during the durability service accumulation if failure of the catalytic converter activates an audible and/or visual signal approved by the Administrator which alerts the vehicle operator to the need for catalytic converter maintenance, or if the need for periodic maintenance of the catalytic converter is overtly signalled to the vehicle operator by an appropriate means, e.g., an indicator light or significantly reduced driveability performance.

(g) Certain engine components may require maintenance which, by its nature, cannot be scheduled for periodic intervals, but which the manufacturer believes will be necessary. For example, piston and cylinder replacement caused by piston seizure which results in the vehicle being inoperative; or, in the case of two-stroke engines, decarbonization, the need for which is signalled to the vehicle operator by significantly reduced driveability performance. Such maintenance is designated anticipated maintenance. Anticipated maintenance must be identified by the manufacturer and approved as being appropriate by the Administrator prior to the start of service accumulation. The approximate distance at which the need for anticipated maintenance may arise must be specified in the application for certification.

(h) Complete emission tests (see Subpart F) are required, unless waived by the Administrator, before and after any vehicle maintenance which may reasonably be expected to affect emissions.

§ 86.428–80 Maintenance, scheduled; test vehicles.

(a) Periodic maintenance on the engine, emission control system, and fuel system of test vehicles shall be scheduled for performance at the same distance intervals that will be specified in the manufacturer's maintenance instructions furnished to the ultimate purchaser. Such maintenance shall be performed only under the following provisions.

(b) Periodic major engine tune-ups to the manufacturer's specifications may be performed no more frequently than as follows nor may any tune-up be performed within 1000 km prior to the official test.

Displacement class:	*Minimum interval (Kilometer)*
I	3,000
II	3,000
III	4,000

(c) A scheduled major engine tune-up shall be restricted to items listed below and shall be conducted in a manner consistent with service instructions and specifications provided by the manufacturer for use by customer service personnel. The following items may be inspected, replaced, cleaned, adjusted, and/or serviced as required: (1) Breaker points, timing, (2) idle speed and idle air/fuel mixture, (3) valve lash, (4) engine bolt torque, and (5) spark plugs.

(d) The Administrator will specify the ignition timing, idle air fuel mixture and other fuel system adjustments to be used at each tune-up. The settings selected will be those the Administrator deems appropriate within the physically available range.

(e) Periodic change of engine and transmission oil, and change or service of oil, air, and fuel filters will be allowed at the same distance intervals that will be specified in the manufacturer's maintenance instructions.

(f) Requests for authorization of periodic maintenance of emission control related components not specifically authorized to be maintained by this section, and for anticipated maintenance (see § 86.428), must be made prior to the beginning of distance accumulation. The Administrator will approve the performance of such maintenance if the manufacturer makes a satisfactory showing that the maintenance will be performed on vehicles in use and that the maintenance is reasonable and necessary.

(1) The EGR system may be serviced a maximum of two times during the durability service accumulation if failure of the EGR system activates an audible and/or visual signal approved by the Administrator which alerts the vehicle operator to the need for EGR system maintenance, or if the need for periodic maintenance of the EGR system is overtly signalled to the vehicle operator by an appropriate means, e.g., an indicator light or significantly reduced driveability performance.

(2) The catalytic converter may be serviced only once during the durability service accumulation if failure of the catalytic converter activates an audible and/or visual signal approved by the Administrator which alerts the vehicle operator to the need for catalytic converter maintenance, or if the need for periodic maintenance of the catalytic converter is overtly signalled to the vehicle operator by an appropriate means, e.g., an indicator light or significantly reduced driveability performance.

(g) Certain engine components may require maintenance which, by its nature, cannot be scheduled for periodic intervals, but which the manufacturer believes will be necessary. For example, piston and cylinder replacement caused by piston seizure which results in the vehicle being inoperative; or in the case of two-stroke engines, decarbonization, the need for which is signalled to the vehicle operator by significantly reduced driveability performance. Such maintenance is designated anticipated maintenance. Anticipated maintenance must be identified by the manufacturer and approved as being appropriate by the Administrator prior to the start of service accumulation. The approximate distance at which the need for anticipated maintenance may arise must be specified in the application for certification.

(h) Complete emission tests (see Subpart F) are required, unless waived by the Administrator, before and after any vehicle maintenance which may reasonably be expected to affect emissions.

§ 86.429–78 Maintenance, unscheduled; test vehicles.

(a) Any unscheduled engine, emission control system, or fuel system adjustment, repair, removal, disassembly, cleaning, or replacement on vehicles shall be performed only with the advance approval of the Administrator.

(1) In the case of unscheduled maintenance, such approval will be given if the Administrator:

(i) Has made a preliminary determination that part failure or system malfunction, or the repair of such failure or malfunction, does not render the vehicle unrepresentative of vehicles in use, and does not require direct access to the combustion chamber, except for spark plug, fuel injection component, or removable prechamber removal or replacement; and

(ii) Has made a determination that the need for maintenance or repairs is indicated by an overt indication of malfunction such as persistent misfire, vehicle stall, overheating, fluid leakage, loss of oil pressure, or charge indicator warning.

(2) Emission measurements may not be used as a means of determining the need for unscheduled maintenance under paragraph (a) (1) (i) of this section.

(b) Repairs to vehicle components of test vehicles, other than the engine, emission control system, or fuel system, shall be performed only as a result of part failure, vehicle system malfunction, or with the advance approval of the Administrator.

(c) The Administrator shall be given the opportunity to verify the extent of an overt indication of part failure and/or

vehicle malfunction (e.g., misfire, stall), or an activation of an audible and/or visual signal, prior to the performance of any maintenance to which such overt indication or signal is relevant under the provisions of this section.

(d) Equipment, instruments, or tools may not be used to identify malfunctioning, maladjusted, or defective engine components unless the same or equivalent equipment, instruments, or tools will be available at dealerships and other service outlets and

(1) Are used in conjunction with scheduled maintenance on such components, and

(2) Are used subsequent to the identification of a vehicle or engine malfunction, as provided in paragraph (a)(1) of this section for durability or emission data vehicles, or

(3) Unless specifically authorized by the Administrator.

(e) If the Administrator determines that part failure or system malfunction occurrence and/or repair rendered the vehicle unrepresentative of vehicles in use, the vehicle shall not be used as a test vehicle.

(f) Complete emission tests are required, unless waived by the Administrator, before and after any vehicle maintenance which may reasonably be expected to affect emissions.

§ 86.430–78 Vehicle failure.

(a) Any test vehicle which incurs major mechanical failure necessitating disassembly of the engine shall not be used as a test vehicle. This prohibition does not apply to failures occurring after the official test at the total test distance.

§ 86.431–78 Data submission.

(a) Data from all tests (including voided tests) shall be air posted to the Administrator within 72 hours (or delivered within five working days). In addition, all test data shall be compiled and provided to the Administrator. Failure to comply with these requirements may invalidate all test data submitted for the test vehicle.

(b) The manufacturer shall furnish to the Administrator explanation for voiding any test. The Administrator will determine if voiding the test was appropriate based upon the explanation given by the manufacturer. If the Administrator determines that voiding the test was not appropriate, the Administrator may require that the data from that test be used in the calculation of the deterioration factor for emissions.

(c) When unscheduled or anticipated maintenance is performed, a complete record of all pertinent maintenance, including a preliminary engineering report of any malfunction diagnosis and the corrective action taken shall be included with the test data. A complete engineering report shall be delivered or air posted to the Administrator within 10 working days after the tests. In addition all test data and maintenance reports shall be compiled and provided to the Administrator.

(d) A complete record of all maintenance shall be supplied.

§ 86.432–78 Deterioration factor.

(a) Deterioration factors shall be developed for each test vehicle from the emission test results. A separate factor shall be developed for each pollutant. Results of all valid tests performed by the manufacturer shall be used. When the Administrator conducts service accumulation, results from all tests he performed shall be used.

(b) Emission results which are less than 0.10 g/km shall be considered to be 0.10 g/km for purposes of this section.

(c) Test results for each pollutant shall be plotted as a function of the service accumulated at the start of the emission test, rounded to the nearest kilometre. These results shall be correlated to a straight line, fit by the method of least squares.

(d) An exhaust emission deterioration factor will be calculated by dividing the predicted emissions at the useful life distance by the predicted emissions at the total test distance. Predicted emissions are obtained from the correlation developed in paragraph (c) of this section.

$$\text{Factor} = \frac{\text{Predicted total distance emissions}}{\text{Predicted total test distance emissions}}$$

These interpolated and extrapolated values shall be carried out to four places to the right of the decimal point before dividing one by the other to determine the deterioration factor. The results shall be rounded to three places to the right of the decimal point in accordance with ASTM E 29–67.

(e) Deterioration factors computed to be less than 1.0 shall be 1.0.

§ 86.433–78 [Reserved]

§ 86.434–78 Official emission tests.

(a) At the conclusion of service accumulation, and after emission tests for deterioration, the vehicle shall receive an official emission test. The Administrator shall designate where this test will occur.

(b) The manufacturer may request a second official test. The results of the second test will be used to determine compliance.

(c) If the emission results from the official test exceed the standards (without correction for deterioration), certification will be denied.

§ 86.435–78 Extrapolated emission values.

(a) If the deterioration factor lines are below the standards between the minimum test distance and the useful life, or if all points used to generate the lines are below the standards, predicted useful life emissions shall be calculated. If not, the manufacturers may elect to withdraw the vehicle or accumulate additional service.

(b) The emission results of each pollutant obtained from the official test will be multiplied by the appropriate deterioration factor to determine useful life emissions.

(1) If the useful life emissions are below the standards, certification will be granted.

(2) If any of the useful life emissions exceed the emission standards, the vehicle must (if not withdrawn) accumulate distance to the useful life.

§ 86.436–78 Additional service accumulation.

(a) Additional service up to the useful life will be accumulated under the same conditions as the initial service accumulation.

(b) New deterioration lines will be generated using all test points (except the first official EPA test) up to the useful life. The same procedures for determining the original deterioration line will be used.

(c) The vehicle will receive a final EPA official test. The manufacturer may request a second test. The results of the second test will be used to determine compliance.

(d) To qualify for certfication:

(1) The final EPA official test results must be below the standards, and

(2) The deterioration line must be below the standard at the minimum test distance and the useful life, or all points used to generate the line, must be below the standard.

(e) If the vehicle is unable to complete the total distance due to engine mechanical failure, certification will be granted if:

(1) The mechanical failure was anticipated, § 86.428, and

(2) A new deterioration line using all available data, except the official EPA test, is below the standard at the minimum test distance and at the useful life, and

(3) The results of the EPA official test, when adjusted by the new deterioration factor, are below the standards.

(f) The provisions of this section are graphically depicted in Figure E78–3.

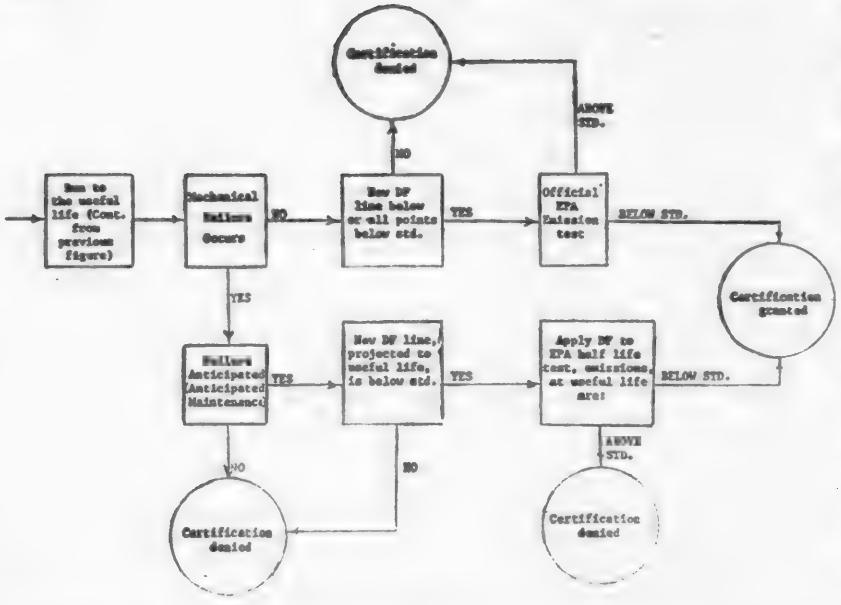


Figure E78-3 Additional Distance Accumulation

§ 86.437–78 Certification.

(a) New motorcycles produced by a manufacturer whose projected sales in the United States is 10,000 or more units (for the model year in which certification is sought) are covered by the following:

(1) The manufacturer shall submit to the Administrator a statement that the test vehicles with respect to which data are submitted have been tested in accordance with the applicable test procedures, that they meet the requirements of such tests, and that, on the basis of such tests, they conform to the requirements of the regulations in this part. If such statements cannot be made with respect to any vehicle tested, the vehicle shall be identified, and all pertinent test data relating thereto shall be supplied.

(2) (i) If, after a review of the test reports and data submitted by the manufacturer, data derived from any inspection carried out under § 86.441 and any other pertinent data or information, the Administrator determines that a test vehicle(s) meets the requirements of the Act and of this subpart, he will issue a certificate of conformity with respect to such vehicle(s) except in cases covered by § 86.442.

(ii) Such certificate will be issued for such period not to exceed one model year as the Administrator may determine and upon such terms as he may deem necessary to assure that any new motorcycle covered by the certificate will meet the requirements of the Act and of this subpart. Each such certificate shall contain the following language:

This certificate covers only those new motorcycles which conform in all material respects, to the design specifications that applied to those vehicles described in the application for certification and which are produced during the ____ model year period of the said manufacturer, as defined in 40 CFR § 86.402.

It is a term of this certificate that the manufacturer shall consent to all inspections described in 40 CFR 86.441 which concern either the vehicle certified, or any production vehicle covered by this certificate, or any production vehicle which when completed will be claimed to be covered by this certificate. Failure to comply with all the requirements of § 86.441 with respect to any such vehicle may lead to revocation or suspension of this certificate as specified in 40 CFR 86.442. It is also a term of this certificate that this certificate may be revoked or suspended for the other reasons stated in § 86.442.

(iii) The certificate will cover all vehicles represented by the test vehicle and will certify compliance with no more than one set of applicable standards.

(3) (i) If, after a review of the test reports and data submitted by the manufacturer, data derived from any additional testing conducted pursuant to § 86.427, or information derived from any inspection carried out under § 86.441, or any other pertinent data or information, the Administrator determines that one or more test vehicles of the certification test fleet do not meet applicable standards, he will notify the manufacturer in writing, setting forth the basis for his determination. The manufacturer may request a hearing on the Administrator's determination.

(ii) The manufacturer may, at his option, proceed with any of the following alternatives with respect to any vehicles represented by a test vehicle(s) determined not in compliance with applicable standards:

(A) Request a hearing.

(B) Delete from the application for certification the vehicles represented by the failing test vehicle. (Vehicles so deleted may be included in a later request for certification under paragraph (b)(2)(iii) of this section.) The Administrator will then select in place of each failing vehicle an alternate vehicle chosen in accordance with selection criteria employed in selecting the vehicle that failed, or

(C) Repair the test vehicle and demonstrate by testing that it meets applicable standards. Another vehicle which is in all material respects the same as the first vehicle, as repaired, shall then be operated and tested in accordance with applicable test procedures.

(iii) If the manufacturer does not request a hearing or present the required data under subparagraph (2) of this paragraph, the Administrator will deny certification.

(b) New motorcycles produced by a manufacturer whose projected sales in the United States is less than 10,000 units (for the model year in which certification is sought) are covered by the following:

(1) The manufacturer shall submit to the Administrator an application for certification containing the following:

(i) A brief description of the vehicles to be covered by the certificate (the manufacturer's sales data book or advertising including specifications will satisfy this requirement for most manufacturers).

(ii) A statement signed by an authorized representative of the manufacturer stating: "The vehicles described herein have been tested in accordance with the provisions of Subpart E, Title 40, United States Code of Federal Regulations, and on the basis of those tests are in conformance with that Subpart. All of the data and records required by that Subpart are on file and are available for inspection by the Administrator. Total sales of vehicles subject to this Subpart will be limited to less than 10,000 units."

(2) If, after a review of the statement the Administrator determines that the requirements of this subpart have been met, he will issue a certificate of conformity with respect to the described vehicles except in cases covered by § 86.442.

(3) Such certificate will be issued for such a period not to exceed one model year as the Administrator may determine and upon such terms as he may deem necessary to assure that any new motorcycle covered by the certificate will meet the requirements of the Act and of this subpart. Each such certificate shall contain the following language:

This certificate covers no more than 9999 new motorcycles as described in the application for certification, and the records required in 40 CFR 86.416, manufactured by ---------- and which are produced during the _____ model year period of the said manufacturer, as defined in 40 CFR 86.402.

It is a term of this certificate that the manufacturer shall consent to all inspections described in 40 CFR 86.441 which concern either the vehicle certified or any production vehicle covered by this certificate or any production vehicle which when completed will be claimed to be covered by this certificate. Failure to comply with all the requirements of § 86.441 with respect to any such vehicle may lead to revocation or suspension of this certificate as specified in 40 CFR 86.442. It is a term of this certificate that this certificate may be revoked or suspended

for the other reasons stated in § 86.442. It is also a term of this certificate that no changes shall be made to the vehicles covered by this certificate that will cause the vehicle's emissions to exceed the applicable emission standards as set forth in this chapter.

(4) The certificate will cover all vehicles described by the manufacturer.

(5)(i) If, after a review of the statements and descriptions submitted by the manufacturer, the Administrator determines that the applicable requirements have not been met, he will notify the manufacturer in writing, setting forth the basis for his determination. The manufacturer may request a hearing on the Administrator's determination.

(ii) If the manufacturer does not request a hearing or present the required information the Administrator will deny certification.

§ 86.438–78 Amendments to the application.

(a) The manufacturer shall inform the Administrator by way of amendment to the application of any proposed changes to vehicles in production or additional vehicles to be produced. The Administrator will, if appropriate, select a new test vehicle. Except as provided in § 86.439, no changes may be instituted until approved by the Administrator.

(b) The Administrator may allow reduced testing.

§ 86.439–78 Alternative procedure for amending certificates of conformity.

(a) A manufacturer, in lieu of notifying the Administrator in advance of an addition of a vehicle under § 86.438, may notify him by appropriate amendment to the application for certification concurrently with implementation of the change or addition if the manufacturer determines on the basis of emission data that the addition or change will not adversely affect (cause to increase above the applicable standards) emissions from the affected vehicles. Upon such notification, the manufacturer may proceed to put the addition or change into effect. The applicable certificate of conformity then in effect will be deemed amended as set forth in the amended application unless and until the amendment is rejected by the Administrator under paragraph (c) of this section.

(b) The manufacturer may continue to produce vehicles as described in the amendment to the application for certification for a maximum of 30 days, unless the Administrator grants an extension in writing. This period may be shortened by a notification in accordance with paragraph (c) of this section.

(c) If the Administrator determines, based upon the description of the amendment to the application, that no additional test data will be required, he will notify the manufacturer in writing of the acceptability of the amended application. If the Administrator determines that additional test data will be required, he will so notify the manufacturer and proceed as in § 86.438.

(d) Election to produce vehicles under this section will be deemed to be a consent to recall all vehicles which the Administrator determines under § 86.438 do not meet applicable standards, and to cause such nonconformity to be remedied at no expense to the owner.

(e) Any changed or added vehicles produced after the manufacturer is notified of the rejected application amendment will not be covered by a certificate of conformity.

§ 86.440–78 Maintenance of records.

(a) The manufacturer of any motorcycle subject to any of the standards or procedures prescribed in this subpart shall establish, maintain and retain the following adequately organized and indexed records:

(1) *General records.* (i)(A) Identification and description of all certification vehicles for which testing is required under this subpart.

(B) A description of all emission control systems which are installed on or incorporated in each certification vehicle.

(C) A description of all procedures used to test each such certification vehicle.

(ii) A properly completed application, following the format prescribed by the U.S. EPA for the appropriate year of production, fulfills each of the requirements of this paragraph.

(2) *Individual records.* (i) A brief history of each motorcycle used for certification under this subpart in the form of a separate booklet or other document for each separate vehicle in which shall be recorded:

(A) In the case where a current production engine is modified for use in a certification vehicle, a description of the process by which the engine was selected and of the modification made, giving specifically the place of modification and installation of the engine into the certification vehicle and the person(s) in charge of modification and installation. In the case where the engine for a certification vehicle is not derived from a current production engine, a general description of the build-up of the engine (e.g., experimental heads were cast and machined according to supplied drawings, etc.) giving specifically the place of engine assembly and installation into a certification vehicle and the person(s) in charge of engine assembly and installation. In both cases above, a description of the origin and selection process for the carburetor, fuel system, emission control system components, and exhaust after treatment device shall be included. The required descriptions shall specify the steps taken to assure that the certification vehicle with respect to its engine, drive train, fuel system, emission control system components, exhaust after treatment device, vehicle mass, or any other device or component that can reasonably be expected to influence exhaust emissions, will be represented of production vehicles, and that either all components and/or vehicle construction processes, component inspection and selection techniques, and assembly techniques employed in constructing such vehicles are reasonably likely to be implemented for production vehicles or that they are as closely analogous as practicable to planned construction and assembly processes.

(B) A complete record of all emission tests performed (except tests performed by EPA directly), including all individual worksheets and/or other documentation relating to each such test, or exact copies thereof; the date, time, purpose, and location of each test; the distance accumulated on the vehicle when the test began and ended; and the names of supervisory personnel responsible for the conduct of the test.

(C) The date and times of each service accumulation run, listing both the distance accumulated and the name of each rider or each operator of the automatic service accumulation device.

(D) If used, the record of any devices employed to record the speed and/or distance in relationship to time of the test vehicle.

(E) A record and description of all maintenance and other servicing performed, giving the date and time of the maintenance or service, the reason for it, the person authorizing it, and the names of supervisory personnel responsible for the conduct of the maintenance or service. The description shall indicate whether or not EPA specifically consented to the work and, if EPA did not, shall list the provision of this subpart which authorizes its performance.

(F) A record and description of each test performed to diagnose engine or emissions control system performance, giving the date and time of test, the reason for it, the person authorizing it, and the names of supervisory personnel responsible for the conduct of the test.

(G) The dates and times that the vehicle was idle in storage, in transit or transport, and required soak periods.

(H) A brief description of any significant events affecting the vehicle during any time in the period covered by the history not described by an entry under one of the previous headings including such extraordinary events as vehicle accidents or rider speeding citations or warnings.

(ii) Each such history shall be started on the date that the first of any of the selection of build-up activities in paragraph (a)(2)(i)(A) of this section occurred with respect to the certification vehicle, shall be updated each time the operational status of the vehicle changes or additional work is performed on it, and shall be kept in a designated location.

(3) All records required to be maintained under this subpart shall be retained by the manufacturer for a period of six (6) years after issuance of all certificates of conformity to which they relate. Records may be retained as hard copy or reduced to microfilm, punch cards, etc., depending on the record retention procedures of the manufacturer: *Provided*, That in every case all the information contained in the hard copy shall be retained.

§ 86.441–78 Right of entry.

(a) Any manufacturer who has applied for certification of a new motorcycle subject to certification tests under this Subpart shall admit or cause to be admitted

any EPA Enforcement Officer during operating hours on presentation of any credentials to any of the following:

(1) Any facility where any such tests or any procedures or activities connected with such tests are or were performed.

(2) Any facility where any new motorcycle which is being, was or is to be tested is present.

(3) Any facility where any construction process or assembly process used in the modification or build-up of such a vehicle into a certification vehicle is taking place or has taken place.

(4) Any facility where any record or other document relating to any of the above is located.

(b) Upon admission to any facility referred to in paragraph (c)(1) of this section, any EPA Enforcement Officer shall be allowed:

(1) To inspect and monitor any part or aspect of such procedures, activities, and testing facilities, including, but not limited to, monitoring vehicle preconditioning, emissions tests and service accumulation, maintenance, and vehicle soak and storage procedures; and to verify correlation or calibration of test equipment;

(2) To inspect and make copies of any such records, designs, or other documents; and

(3) To inspect and/or photograph any part or aspect of any such certification vehicle and any components to be used in the construction thereof.

(c) In order to allow the Administrator to determine whether or not production motorcycles conform in all material respects to the design specifications which applied to those vehicles described in the application for certification for which a certificate of conformity has been issued and to standards prescribed under section 202 of the Act, any manufacturer shall admit any EPA Enforcement Officer on presentation of credentials to both:

(1) Any facility where any document, design, or procedure relating to the translation of the design and construction of engines and emission related components described in the application for certification or used for certification testing into production vehicles is located or carried on; and

(2) Any facility where any motorcycles to be introduced into commerce are manufactured or assembled.

(d) On admission to any such facility referred to in paragraph (c)(3) of this section, any EPA Enforcement Officer shall be allowed:

(1) To inspect and monitor any aspects of such manufacture or assembly and other procedures;

(2) To inspect and make copies of any such records, documents or designs; and

(3) To inspect and photograph any part or aspect of any such new motorcycles and any component used in the assembly thereof that are reasonably related to the purpose of his entry.

(e) Any EPA Enforcement Officer shall be furnished by those in charge of a facility being inspected with such reasonable assistance as he may request to help him discharge any function listed in this paragraph. Each applicant for or recipient of certification is required to cause those in charge of a facility operated for its benefit to furnish such reasonable assistance without charge to EPA whether or not the applicant controls the facility.

(f) The duty to admit or cause to be admitted any EPA Enforcement Officer applies whether or not the applicant owns or controls the facility in question and applies both to domestic and to foreign manufacturers and facilities. EPA will not attempt to make any inspections which it has been informed that local law forbids. However, if local law makes it impossible to do what is necessary to insure the accuracy of data generated at a facility, no informed judgment that a vehicle or engine is certifiable or is covered by a certificate can properly be based on that data. It is the responsibility of the manufacturer to locate its testing and manufacturing facilities in jurisdictions where this situation will not arise.

(g) For purposes of this section:

(1) "Presentation of credentials" shall mean display of the document designating a person as an EPA Enforcement Officer.

(2) Where vehicle, component, or engine storage areas or facilities are concerned, "operating hours" shall mean all times during which personnel other than custodial personnel are at work in the vicinity of the area or facility and have access to it.

(3) Where facilities or areas other than those covered by paragraph (g)(2) of this section are concerned, "operating hours" shall mean all times during which an assembly line is in operation or all times during which testing, maintenance, service accumulation, production or compilation of records, or any other procedure or activity related to certification testing, to translation of designs from the test stage to the production stage, or to vehicle manufacture or assembly is being carried out in a facility.

(4) "Reasonable assistance" includes, but is not limited to, clerical, copying, interpretation and translation services, the making available on request of personnel of the facility being inspected during their working hours to inform the EPA Enforcement Officer of how the facility operates and to answer his questions, and the performance on request of emissions tests on any vehicle which is being, has been, or will be used for certification testing. Such tests shall be nondestructive, but may require appropriate service accumulation. A manufacturer may be compelled to cause the personal appearance of any employee at such a facility before an EPA Enforcement Officer by written request for his appearance, signed by the Assistant Administrator for Enforcement, served on the manufacturer. Any such employee who has been instructed by the manufacturer to appear will be entitled to be accompanied, represented, and advised by counsel. No counsel who accompanies, represents, or advises an employee compelled to appear may accompany, represent, or advise any other person in the investigation.

(5) Any entry without 24 hours prior written or oral notification to the affected manufacturer shall be authorized in writing by the Assistant Administrator for Enforcement.

§ 86.442-78 Denial, revocation, or suspension of certification.

(a) Notwithstanding the fact that any certification vehicle(s) may comply with other provisions of this subpart, the Administrator may withhold or deny the issuance of a certificate of conformity (or suspend or revoke any such certificate which has been issued) with respect to any such vehicle(s) if:

(1) The manufacturer submits false or incomplete information in his application of certification thereof; or

(2) The manufacturer renders inaccurate or invalid any test data which he submits pertaining thereto or otherwise circumvents the intent of the Act or of this subpart with respect to such vehicle; or

(3) Any EPA Enforcement Officer is denied access on the terms specified in § 86.441 to any facility or portion thereof which contains any of the following:

(i) The vehicle, or

(ii) Any components used or considered for use in its modification or build-up into a certification vehicle, or

(iii) Any production vehicle which is or will be claimed by the manufacturer to be covered by the certificate, or

(iv) Any step in the construction of a vehicle described in (c) of this subdivision, or

(v) Any records, documents, reports, or histories required by this Part to be kept concerning any of the above.

(4) Any EPA Enforcement Officer is denied "reasonable assistance" (as defined in § 86.444) in examining any of the items listed in paragraph (a)(1)(iii) of this section.

(b) The sanctions of withholding, denying, revoking, or suspending of a certificate may be imposed for the reasons in paragraph (a) of this section only when the infraction is substantial.

(c) In any case in which a manufacturer knowingly submits false or inaccurate information, or knowingly renders inaccurate or invalid any test data, or commits any fraudulent acts and such acts contribute substantially to the Administrator's decision to issue a certificate of conformity, the Administrator may deem such certificate void ab initio.

(d) In any case in which certification of a vehicle is proposed to be withheld, denied, revoked, or suspended under paragraphs (a)(3) or (a)(4) of this section, and in which the Administrator has presented to the manufacturer involved reasonable evidence that a violation of § 86.441 in fact occurred, the manufacturer, if he wishes to contend that, even though the violation occurred, the vehicle in question was not involved in the violation to a degree that would warrant withholding, denial, revocation, or suspension of certification under either paragraphs (a)(3) or (a)(4) of this section, shall have the burden of

establishing that contention to the satisfaction of the Administrator.

(e) Any revocation or suspension of certification under paragraph (a) of this section shall:

(1) Be made only after the manufacturer concerned has been offered an opportunity for a hearing conducted in accordance with § 86.444 hereof.

(2) Extend no further than to forbid the introduction into commerce of vehicles previously covered by the certification which are still in the hands of the manufacturer, except in cases of such fraud or other misconduct as makes the certification invalid ab initio.

(f) The manufacturer may request in the form and manner specified in § 86.443 that any determination made by the Administrator under paragraph (a) of this section to withhold or deny certification be reviewed in a hearing conducted in accordance with § 86.444. If the Administrator finds, after a review of the request and supporting data, that the request raises a substantial factual issue, he will grant the request with respect to such issue.

§ 86.443–78 Request for hearing.

Within 30 days following receipt of notification that an application has been rejected or that certification has been denied, the manufacturer may request a hearing on the Administrator's determination. The request shall be in writing, signed by an authorized representative of the manufacturer and shall include a statement specifying the manufacturer's objections to the Administrator's determinations, and data in support of such objections. If, after the review of the request and supporting data, the Administrator finds that the request raises a substantial factual issue, he shall provide the manufacturer a hearing with respect to such issue.

§ 86.444–78 Hearings on certification.

(a) (1) After granting a request for a hearing under § 86.443 the Administrator will designate a Presiding Officer for the hearing.

(2) The General Counsel will represent the Environmental Protection Agency in any hearing under this section.

(3) If a time and place for the hearing have not been fixed by the Administrator under § 86.443, the hearing shall be held as soon as practicable at a time and place fixed by the Administrator or by the Presiding Officer.

(4) In the case of any hearing requested pursuant to § 86.437, the Administrator may in his discretion direct that all argument and presentation of evidence be concluded within such fixed period not less than 30 days as he may establish from the date that the first written offer of a hearing is made to the manufacturer. To expedite proceedings, the Administrator may direct that the decision of the Presiding Officer (who may, but need not be the Administrator himself) shall be the final EPA decision.

(b) (1) Upon his appointment pursuant to paragraph (a) of this section, the Presiding Officer will establish a hearing file. The file shall consist of the notice issue by the Administrator under a hearing and the supporting data submitted therewith and all documents relating to the request for certification and all documents submitted therewith, and correspondence and other data material to the hearing.

(2) The appeal file will be available for inspection by the applicant at the office of the Presiding Officer.

(c) An applicant may appear in person, or may be represented by counsel or by any other duly authorized representative.

(d) (1) The Presiding Officer upon the request of any party, or in his discretion, may arrange for a prehearing conference at a time and place specified by him to consider the following:

(i) Simplification of the issues;

(ii) Stipulations, admissions of fact, and the introduction of documents;

(iii) Limitation of the number of expert witnesses;

(iv) Possibility of agreement disposing of all or any of the issues in dispute;

(v) Such other matters as may aid in the disposition of the hearing, including such additional tests as may be agreed upon by the parties.

(2) The results of the conference shall be reduced to writing by the Presiding Officer and made part of the record.

(e) (1) Hearings shall be conducted by the Presiding Officer in an informal but orderly and expeditious manner. The parties may offer oral or written evidence, subject to the exclusion by the Presiding Officer of irrevelant, immaterial, and repetitious evidence.

(2) Witnesses will not be required to testify under oath. However, the Presiding Officer shall call to the attention of witnesses that their statements may be subject to the provisions of Title 18 U.S.C. 1001 which imposes penalties for knowingly making false statements or representations, or using false documents in any matter within the jurisdiction of any department or agency of the United States.

(3) Any witness may be examined or cross-examined by the Presiding Officer, the parties, or their representatives.

(4) Hearings shall be reported verbatim. Copies of transcripts of proceedings may be purchased by the applicant from the reporter.

(5) All written statements, charts, tabulations, and similar data offered in evidence at the hearing shall, upon a showing satisfactory to the Presiding Officer of their authenticity, relevancy, and materiality, be received in evidence and shall constitute a part of the record.

(6) Oral argument may be permitted in the discretion of the Presiding Officer and shall be reported as part of the record unless otherwise ordered by him.

(f) (1) The Presiding Officer shall make an initial decision which shall include written findings and conclusions and the reasons or basis therefore on all the material issues of fact, law, or discretion presented on the record. The findings, conclusions, and written decision shall be provided to the parties and made a part of the record. The initial decision shall become the decision of the Administrator without further proceedings unless there is an appeal to the Administrator or motion for review by the Administrator within 20 days of the date the initial decision was filed.

(2) On appeal from or review of the initial decision the Administrator shall have all the powers which he would have in making the initial decision including the discretion to require or allow briefs, oral argument, the taking of additional evidence or the remanding to the Presiding Officer for additional proceedings. The decision by the Administrator shall include written findings and conclusions and the reasons or basis therefore on all the material issues of fact, law, or discretion presented on the appeal or considered in the review.

Subpart F—Emission Regulations for 1978 and Later New Motorcycles; Test Procedures

§ 86.501–78 Applicability.

(a) This subpart contains the motorcycle test procedures specified in Subpart E.

(b) Provisions of this subpart apply to tests performed by both the Administrator and motor vehicle manufacturers.

§ 86.502–78 Definitions.

(a) The definitions in § 86.402–78 apply to this subpart.

§ 86.503–78 Abbreviations.

(a) The abbreviations in § 86.403–78 apply to this subpart.

§ 86.504–78 Section numbering.

(a) The section numbering system described in § 86.404–78 is used in this subpart.

§ 86.505–78 Introduction; structure of subpart.

(a) This subpart describes the equipment required and the procedures to follow in order to perform exhaust emission tests on motorcycles. Subpart E sets forth the testing requirements and test intervals necessary to comply with EPA certification procedures.

(b) Three topics are addressed in this subpart. Sections 86.508 through 86.515 set forth specifications and equipment requirements; §§ 86.516 through 86.526 discuss calibration methods and frequency; test procedures and data requirements are listed (in approximate order of performance) in §§ 86.527 through 86.544.

§ 86.506 [Reserved]

§ 86.507 [Reserved]

§ 86.508–78 Dynamometer.

(a) The dynamometer shall have a single roll with a diameter of at least 0.400 metre.

(b) The dynamometer shall be equipped with a roll revolution counter for measuring actual distance traveled.

(c) Flywheels or other means shall be used to stimulate the inertia specified in § 86.529 within a tolerance of ±3kg.

(d) A variable speed cooling blower shall direct air to the vehicle. The blower outlet shall be at least 0.40 m² (4.31 ft²) and shall be squarely positioned between 0.3 m (0.98 ft) and 0.45 m (1.48 ft) in front of the vehicle's front wheel. The velocity of the air at the blower outlet shall be within the following limits (as a function of roll speed):

Actual roll speed	*Allowable cooling air speed*
0 km/h to 5 km/h	0 km/h to 10 km/h.
5 km/h to 10 km/h	0 km/h to roll speed+5 km/h.
10 km/h to 50 km/h	Roll speed ±5 km/h.
50 km/h to 70 km/h	Roll speed ±10 pct.
Above 70 km/h	At least 63 km/h.

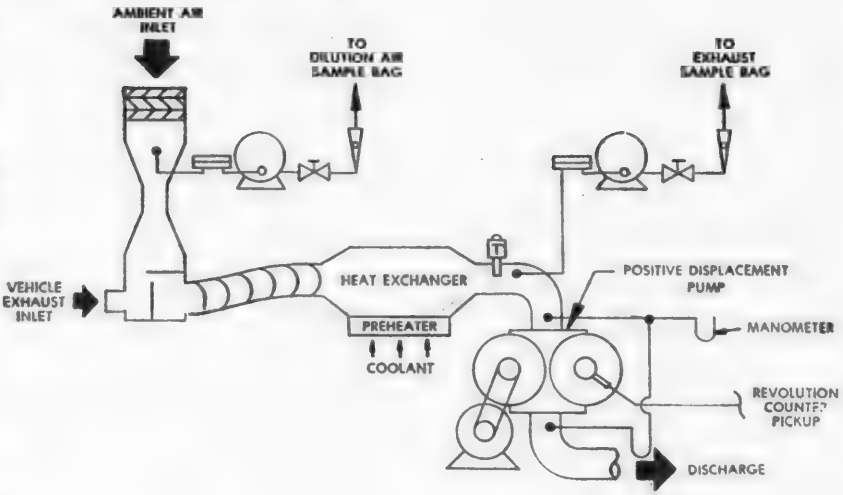
(e) The dynamometer shall comply with the tolerances in § 86.529.

§ 86.509–78 Exhaust gas sampling system.

(a) (1) *General.* The exhaust gas sampling system is designed to measure the true mass emissions of vehicle exhaust. In the CVS concept of measuring mass emissions, two conditions must be satisfied: The total volume of the mixture of exhaust and dilution air must be measured, and a continuously proportioned sample of volume must be collected for analysis. Mass emissions are determined from the sample concentration and totalized flow over the test period.

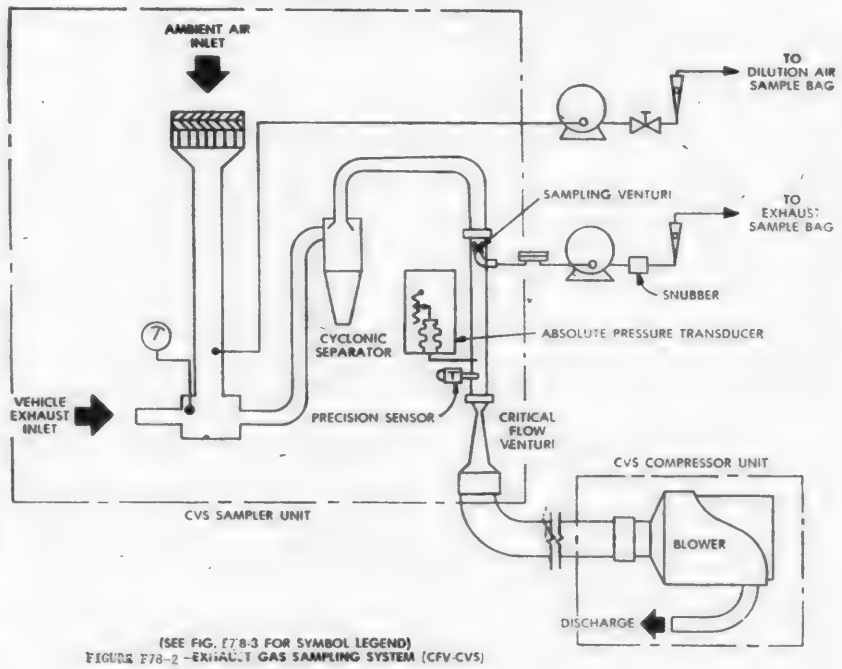
(2) *Positive Displacement Pump.* The Positive Displacement Pump-Constant Volume Sample (PDP–CVS), Figure F78–1, satisfies the first condition by metering at a constant temperature and pressure through the pump. The total volume is measured by counting the revolutions made by the calibrated positive displacement pump. The proportional sample is achieved by sampling at a constant flow rate.

(3) *Critical Flow Venturi.* The operation of the Critical Flow Venturi-Constant Volume Sampler (CFV–CVS), Figure F78–2, is based upon the principles of fluid dynamics associated with critical flow. Proportional sampling is maintained by use of a small CFV in the sample line, which responds to the varying temperatures in the same manner as the main CFV. Total flow per test phase is determined by continuously computing and integrating instantaneous flow. A low response time temperature sensor is necessary for accurate flow calculation.



(SEE FIG. F78-3 FOR SYMBOL LEGEND)

FIGURE F78–1—EXHAUST GAS SAMPLING SYSTEM (PDP-CVS)



(SEE FIG. F78-3 FOR SYMBOL LEGEND)

FIGURE F78–2—EXHAUST GAS SAMPLING SYSTEM (CFV-CVS)

(4) [Reserved]

(5) *Other systems.* Other sampling systems may be used if shown to yield equivalent results, and if approved in advance by the Administrator (e.g., a heat exchanger with the CFV–CVS or an electronic flow integrator without a heat exchanger, with the PDP–CVS).

(b) *Component description, PDP–CVS.* The PDP–CVS, Figure F78–1, consists of a dilution air filter and mixing assembly, heat exchanger, positive displacement pump, sampling system, and associated valves, pressure and temperature sensors. The PDP–CVS shall conform to the following requirements:

(1) Static pressure variations at the tailpipe(s) of the vehicle shall remain within ±1.25 kPa (±5.02 in. H_2O) of the static pressure variations measured during a dynamometer driving cycle with no connection to the tailpipe(s). (Sampling systems capable of maintaining the static pressure to within ±0.25 kPa (±1.00 in H_2O) will be used by the Administrator if a written request substantiates the need for this closer tolerance.)

(2) The gas mixture temperature, measured at a point immediately ahead of the positive displacement pump, shall be within ±5° C (9° F) of the designed operating temperature at the start of the test. The gas mixture temperature variation from its value at the start of the test shall be limited to ±5° C (9° F) during the entire test. The temperature measuring system shall have an accuracy and precision of ±1° C (1.8° F).

(3) The pressure gauges shall have an accuracy and precision of ±0.4 kPa (3 mm Hg).

(4) The location of the dilution air inlet shall be placed and the flow capacity of the CVS shall be large enough to virtually eliminate water condensation in the system.

(5) Sample collection bags for dilution air and exhaust samples shall be of sufficient size so as not to impede sample flow.

(c) *Component description, CFV–CVS.* The CFV–CVS, Figure F78–2, consists of a dilution air filter and mixing assembly, cyclone particulate separator, sampling venturi, critical flow venturi, sampling system, and assorted valves, pressure and temperature sensors. The CFV–CVS shall conform to the following requirements:

(1) Static pressure variations at the tailpipe(s) of the vehicle shall remain within ±1.25 kPa (5.02 in H_2O) of the static pressure variations measured during a dynamometer driving cycle with no connection to the tailpipe(s). (Sampling systems capable of maintaining the static pressure to within ±0.25 kPa (1.00 in H_2O) will be used by the Administrator if a written request substantiates the need for this closer tolerance.)

(2) The temperature measuring system shall have an accuracy and precision of ±1° C (1.8° F) and a response time of 0.100 s to 62.5 percent of a temperature change (as measured in hot silicone oil).

(3) The pressure measuring system shall have an accuracy and precision of ±0.4 kPa (3 mm Hg).

(4) The location of the dilution air inlet shall be placed and the flow capacity of the CVS shall be large enough to virtually eliminate water condensation in the system.

(5) Sample collection bags for dilution air and exhaust samples shall be of sufficient size so as not to impede sample flow.

§ 86.510 [Reserved]

§ 86.511–78 Exhaust gas analytical system.

(a) *Schematic drawing.* Figure F78–3 is a schematic drawing of the exhaust gas analytical system. Since various configurations can produce accurate results, exact conformance with this drawing is not required. Additional components such as instruments, valves, solenoids, pumps, and switches may be used to provide additional information and coordinate the functions of the component systems.

(b) *Major component description.* The analytical system, Figure F78–3, consists of a flame ionization detector (FID) for the determination of hydrocarbons, nondispersive infrared analyzers (NDIR) for the determination of carbon monoxide and carbon dioxide, and, if oxides of nitrogen are measured, a chemiluminescence analyzer (CL) for the determination of oxides of nitrogen. The exhaust gas analytical system shall conform to the following requirements:

(1) The chemiluminescence analyzer requires that the nitrogen dioxide present in the sample be converted to nitric oxide before analysis. Other types of analyzers may be used if shown to yield equivalent results and if approved in advance by the Administrator.

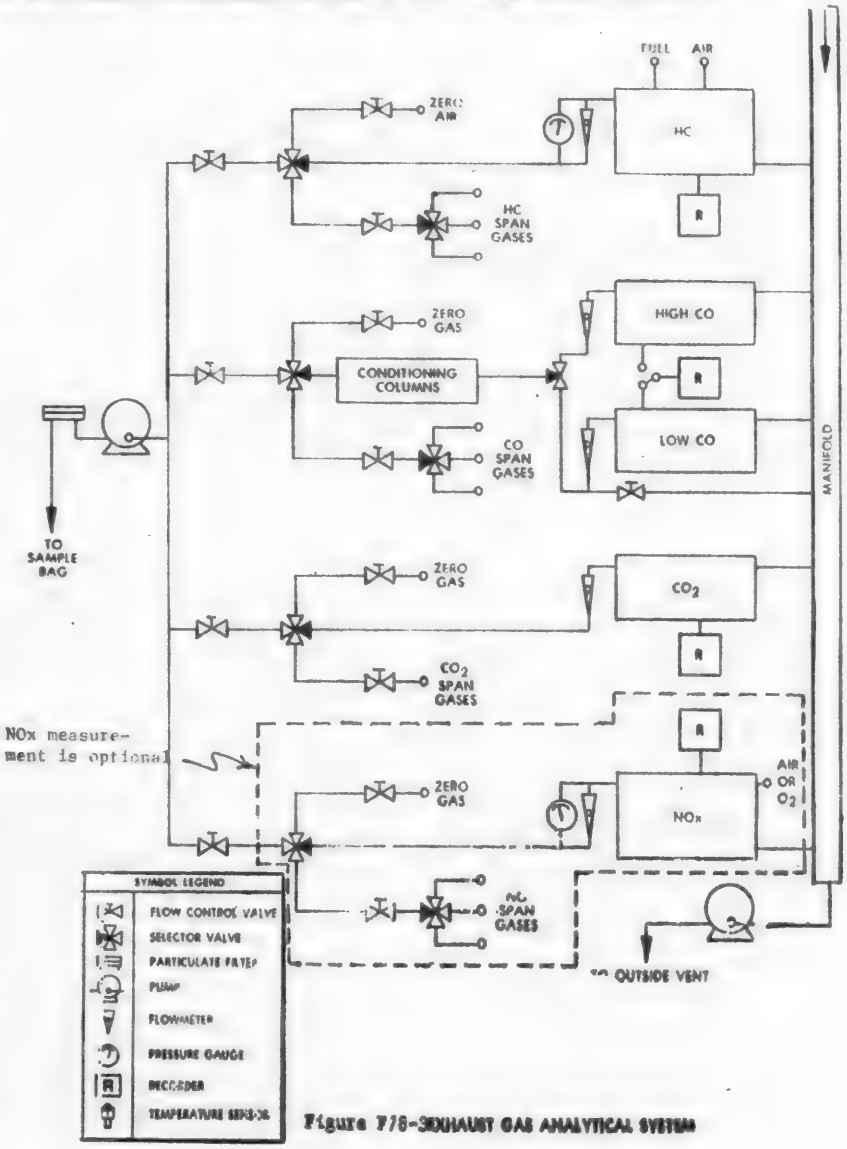


Figure F78-3EXHAUST GAS ANALYTICAL SYSTEM

(2) The carbon monoxide (NDIR) analyzer may require a sample conditioning column containing $CaSO_4$, or indicating silica gel to remove water vapor and containing ascarite to remove carbon dioxide from the CO analysis stream.

(i) If CO instruments which are essentially free of CO_2 and water vapor interference are used, the use of the conditioning column may be deleted, see § 86.522 and § 86.544.

(ii) A CO instrument will be considered to be essentially free of CO_2 and water vapor interference if its response to a mixture of 3 percent CO_2 in N_2 which has been bubbled through water at room temperature produces an equivalent CO response, as measured on the most sensitive CO range, which is less than 1 percent of full scale CO concentration on ranges above 300 ppm full scale or less than 3 ppm on ranges below 300 ppm full scale, see § 86.522.

(c) *Other analyzers and equipment.* Other types of analyzers and equipment may be used if shown to yield equivalent results and if approved in advance by the Administrator.

§ 86.512 [Reserved]

§ 86.513–78 Fuel and engine lubricant specifications.

(a) Gasoline having the following specifications will be used by the Administrator in exhaust emission testing. Gasoline having the following specifications or substantially equivalent specifications approved by the Administrator, shall be used by the manufacturer for emission testing except that the lead and octane specifications do not apply.

Item	ASTM designation	Leaded	Unleaded
Octane, research minimum	D2699	100	96.
Pb (organic), gram/litre (grams/U.S. gallon)		0.370 (1.4) minimum	0.000–0.013 (0.00–0.05)
Distillation range	D86		
IBP, °C (°F)		23.9–35 (75–95)	23.9–35 (75–95).
10 pct point, °C (°F)		48.9–57.2 (120–135)	48.9–57.2 (120–135).
50 pct point, °C (°F)		93.3–110 (200–230)	93.3–110 (200–230).
90 pct point, °C (°F)		148.9–162.8 (300–325)	148.9–162.8 (300–325).
EP, °C (°F), maximum		212.8 (415)	212.8 (415).
Sulfur, mass percent, maximum	D1266	0.10	0.10.
Phosphorus, gram/litre (gram/U.S. gallon), maximum.		0.0026 (0.01)	0.0013 (0.005).
RVP, kPa (psi)	D323	55.2–63.4 (8.0–9.2)	55.2–63.4 (8.0–9.2).
Hydrocarbon composition	D1319		
Olefins, percent, maximum		10	10.
Aromatics, percent maximum		35	35.
Saturates		Remainder	Remainder.

(b) Gasoline and engine lubricants representative of commercial fuels and engine lubricants which will be generally available through retail outlets shall be used in scenic accumulation. For leaded gasoline, the minimum lead content shall be 0.370 gram per litre (1.4 grams per U.S. gallon), except that where the Administrator determines that vehicles represented by a test vehicle will be operated using gasoline of different lead content than that prescribed in this paragraph, he may consent in writing to use a gasoline with a different lead content. This octane rating of the gasoline used shall be no higher than 4.0 Research octane numbers above the minimum recommended by the manufacturer. The Reid Vapor Pressure of the fuel used shall be characteristic of the motor fuel during the season which the service accumulation takes place. If the manufacturer specifies several lubricants to be used by the ultimate purchaser, the Administrator will select one to be used during service accumulation.

(c) The specification range of the fuels and engine lubricants to be used under paragraph (b) of this section shall be reported in accordance with § 86.416.

(d) The same lubricant(s) shall be used for both service accumulation and emission testing.

§ 86.514–78 Analytical gases.

(a) Analyzer gases.

(1) Gases for the CO and CO_2 analyzers shall be single blends of CO and CO_2 respectively using nitrogen as the diluent.

(2) Gases for the hydrocarbon analyzer shall be single blends of propane using air as the diluent.

(3) Gases for the NOx analyzer shall be single blends of NO named as NOx with a maximum NO_2 concentration of 5 percent of the nominal value using nitrogen as the diluent.

(4) [Reserved]

(5) The allowable zero gas (air or nitrogen) impurity concentrations shall not exceed 1 ppm equivalent carbon response, 1 ppm carbon monoxide, 0.04 percent (400 ppm) carbon dioxide, and 0.1 ppm nitric oxide.

(6) "Zero grade air" includes artificial "air" consisting of a blend of nitrogen and oxygen with oxygen concentrations between 18 and 21 mole percent.

(7) The use of proportioning and precision blending devices to obtain the required analyzer gas concentrations is allowable provided their use has been approved in advance by the Administrator.

(b) Calibration gases shall be known to within ±2 percent of the true values.

§ 86.515–78 EPA Urban Dynamometer Driving Schedule.

(a) The dynamometer driving schedules are listed in Appendix I. The driving schedules are defined by a smooth trace drawn through the specified speed vs. time relationships. They consist of a non-repetitive series of idle, acceleration, cruise, and deceleration modes of various time sequences and rates. Appropriate driving schedules are as follows:

Class I—Appendix I(c)
Class II—Appendix I(b)
Class III—Appendix I(b)

(b) The speed tolerance at any given time on the dynamometer driving schedule prescribed in Appendix I or as printed on a driver's aid chart approved by the Administrator, when conducted to meet the requirements of § 86.537 is defined by upper and lower limits. The upper limit is 3.2 km/h (2 mph) higher than the highest point on the trace within 1 second of the given time. The lower limit is 3.2 km/h (2 mph) lower than the lowest point on the trace within 1 second of the given time. Speed variations greater than the tolerances (such as may occur during gear changes) are acceptable provided they occur for less than 2 seconds on any occasion. Speeds lower than those prescribed are acceptable provided the vehicle is operated at maximum available power during such occurrences. When conducted to meet the requirements of § 86.532 the speed tolerance shall be as specified above, except that the upper and lower limits shall be 6.4 km/h (4 mph).

(c) Figure F78–4 shows the range of acceptable speed tolerances for typical points. Figure F78–4(a) is typical of portions of the speed curve which are increasing or decreasing throughout the two second time interval. Figure F78–4 (b) is typical of portions of the speed curve which include a maximum or minimum value.

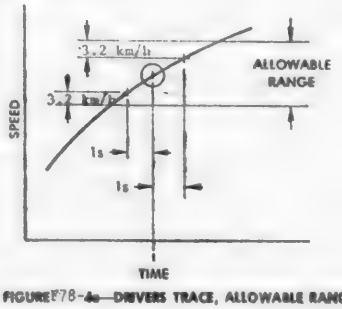


FIGURE F78–4a—DRIVERS TRACE, ALLOWABLE RANGE

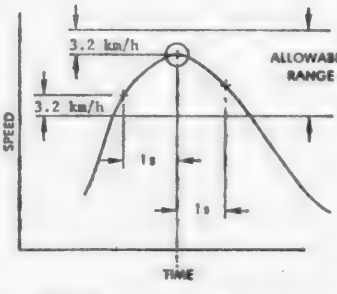


FIGURE F78–4b—DRIVERS TRACE, ALLOWABLE RANGE

§ 86.516–78 Calibrations, frequency and overview.

(a) Calibrations shall be performed s specified in §§ 86.517 through 86.526.

(b) [Reserved]

(c) At least monthly or after any maintenance which could alter calibration, the following calibrations and checks shall be performed:

(1) Calibrate the hydrocarbon analyzer, carbon dioxide analyzer, carbon monoxide analyzer, and, if oxides of nitrogen are measured, oxides of nitrogen analyzer.

(2) Calibrate the dynamometer. If the dynamometer receives a weekly performance check (and remains within calibration), the monthly calibration need not be performed.

(d) At least weekly or after any maintenance which could alter calibration, the following calibrations and checks shall be performed:

(1) Check the oxides of nitrogen converter efficiency, if oxides of nitrogen are measured, and

(2) Perform a CVS system verification, and

(3) Run a performance check on the dynamometer. This check may be omitted if the dynamometer has been calibrated within the preceding month.

(e) The CVS positive displacement pump or Critical Flow Venturi shall be calibrated following initial installation, major maintenance or as necessary when indicated by the CVS system verification (described in § 86.519).

(f) Sample conditioning columns, if used in the CO analyzer train, should be checked at a frequency consistent with observed column life or when the indicator of the column packing begins to show deterioration.

§ 86.517 [Reserved]

§ 86.518–78 Dynamometer calibration.

(a) The dynamometer shall be calibrated at least once each month or performance verified at least once each week and then calibrated as required. The dynamometer is driven above the test speed range. The device used to drive the dynamometer is then disengaged from the dynamometer and the roll is allowed to coast down. The kinetic energy of the system is dissipated by the dynamometer. This method neglects the variations in roll bearing friction due to the drive axle weight of the vehicle.

(b) Calibration shall consist of coasting down the dynamometer for each inertia load combination used. Coastdown times for the interval from 70 to 60 km/h shall be within the tolerances specified in § 86.529. The dynamometer adjustments necessary to produce these results shall be noted for future reference.

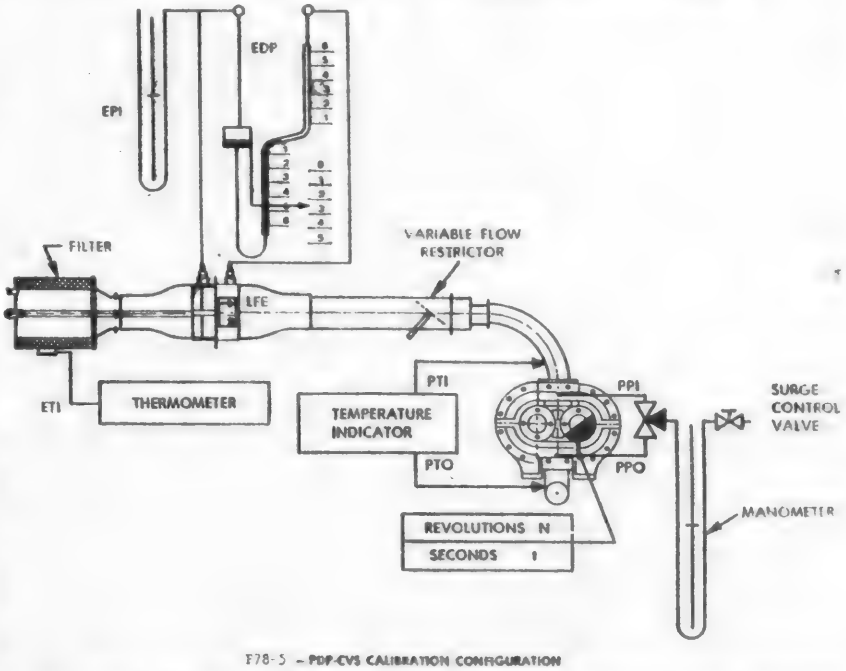
(c) The performance check consists of conducting a dynamometer coastdown at one or more inertia-horsepower settings and comparing the coastdown time to the table in Figure F78–9 of § 86.529–78. If the coastdown time is outside the tolerance, a new calibration is required.

§ 86.519–78 Constant volume sampler calibration.

The CVS (Constant Volume Sampler) is calibrated using an accurate flowmeter and restrictor valve. Measurements of various parameters are made and related to flow through the unit. Procedures used by EPA for both PDP (Positive Displacement Pump) and CFV (Critical Flow Venturi) are outlined below. Other procedures yielding equivalent results may be used if approved in advance by the Administrator. After the calibration curve has been obtained, verification of the entire system can be performed by injecting a known mass of gas into the system and comparing the mass indicated by the system to the true mass injected. An indicated error does not necessarily mean that the calibration is wrong, since other factors can influence the accuracy of the system, e.g. analyzer calibration. A verification procedure is found in paragraph (c) of this section.

(a) *PDP calibration.* (1) The following calibration procedure outlines the equipment, the test configuration, and the various parameters which must be measured to establish the flow rate of the constant volume sampler pump. All the parameters related to the pump are simultaneously measured with the parameters related to a flowmeter which is connected in series with the pump. The calculated flow rate (at pump inlet absolute pressure and temperature) can then be plotted versus a correlation function which is the value of a specific combination of pump parameters. The linear equation which relates the pump flow and the correlation function is then determined. In the event that a CVS has a multiple speed drive, a calibration for each range used must be performed.

(2) This calibration procedure is based on the measurement of the absolute values of the pump and flowmeter paramaters that relate the flow rate at each point. Three conditions must be maintained to assure the accuracy and integrity of the calibration curve. First, the pump pressures should be measured at taps on the pump rather than at the external piping on the pump inlet and outlet. Pressure taps that are mounted at the top center and bottom center of the pump drive headplate are exposed to the actual pump cavity pressures, and therefore reflect the absolute pressure differentials. Secondly, temperature stability must be maintained during the calibration. The laminar flowmeter is sensitive to inlet temperature oscillations which cause the data points to be scattered. Gradual changes (±1° C (1.8° F)) in temperature are acceptable as long as they occur over a period of several minutes. Finally, all connections between the flowmeter and the CVS pump must be absolutely void of any leakage.



F78-5 – PDP-CVS CALIBRATION CONFIGURATION

(3) During an exhaust emission test the measurement of these same pump parameters enables the user to calculate the flow rate from the calibration equation.

(4) Connect a system as shown in Figure F78–5. Although particular types of equipment are shown, other configurations that yield equivalent results may be used if approved in advance by the Administrator. For the system indicated, the following data with given accuracy are required:

Calibration data measurements

Parameter	Symbol	Units	Tolerances
Barometric pressure (corrected)	P_B	kPa (in. Hg)	±0.03 kPa (±0.01 in. Hg).
Ambient temperature	T_A	°C (°F)	±0.3°C (±0.54°F).
Air temperature into LFE	ETI	°C (F)	±0.15°C (±0.27°F).
Pressure depression upstream of LFE	EPI	kPa (in. H_2O)	±0.01 kPa (±0.05 in. H_2O).
Pressure drop across the LFE matrix	EDP	kPa (in. H_2O)	±0.001 kPa (±0.005 in. H_2O).
Air temperature at CVS pump inlet	PTI	°C (°F)	±0.25°C (±0.45°F).
Pressure depression at CVS pump inlet	PPI	kPa (in. Fluid)	±0.021 kPa (±0.046 in. Fluid).
Specific gravity of manometer fluid (1.75 oil)	Sp. Gr.		
Pressure head at CVS pump outlet	PPO	kPa (in. Fluid)	±0.021 kPa (±0.046 in. Fluid)
Air temperature at CVS pump outlet (optional)	PTO	°C (°F)	±0.25°C (±0.45°F).
Pump revolutions during test period	N	Revs	±1 Rev.
Elapsed time for test period	t	s	±0.05 s.

(5) After the system has been connected as shown in Figure F'78–5, set the variable restrictor in the wide open position and run the CVS pump for twenty minutes. Record the calibration data.

(6) Reset the restrictor valve to a more restricted condition in an increment of pump inlet depression (about 1.0 kPa (4" H_2O)) that will yield a minimum of six data points for the total calibration. Allow the system to stabilize for 3 minutes and repeat the data acquisition.

(7) *Data analysis:* (i) The air flow rate, Q_s, at each test point is calculated from the flowmeter data using the manufacturer's prescribed method.

(ii) The air flow rate is then converted to pump flow, V_o, per revolution at absolute pump inlet temperature and pressure.

$$V_o = \frac{Q_s}{n} \times \frac{T_p}{293.15} \times \frac{101.325}{P_p}$$

Where:

V_o=Pump flow, m^3/revolution (ft^3/revolution) at T_p, P_p
Q_s=Meter air flow rate in standard cubic metres per minute, standard conditions are 20° C, 101.3±5 kPa (68° F, 29.92 in. Hg).
n=Pump speed in revolutions per minute.
T_p=Pump inlet temperature, K(R)=PTI+273.15 for English units, T_p=PTI+459.67
P_p=Absolute pump inlet pressure, kPa (in. Hg)=P_B−PPI for English units, P_p=P_B−PPI (SP. GR./13.57)

Where:

P_B=barometric pressure, kPa (in. Hg)
PPI=Pump inlet depression, kPa (in. fluid)
SP. GR.=Specific gravity of manometer fluid relative to water.

(iii) The correlation function at each test point is then calculated from the calibration data:

$$X_o = \frac{1}{n}\sqrt{\frac{\Delta P_p}{P_e}}$$

Where:
X_o=correlation function.
ΔP_p=The pressure differential from pump inlet to pump outlet, kPa (in. Hg)=$P_e - P_p$
P_e=Absolute pump outlet pressure, kPa (in. Hg) =P_B+PPO for English units, P_e=P_B+PPO(SP. GR./13.57)
Where:
PPO=Pressure head at pump outlet, kPa (in. fluid)

(iv) A linear least squares fit is performed to generate the calibration equations which have the forms:

$$V_o = D_o - M(X_o)$$
$$n = A - B(\Delta P_p)$$

D_o, M, A, and B are the slope-intercept constants describing the lines.

(8) A CVS system that has multiple speeds shall be calibrated on each speed used. The calibration curves generated for the ranges will be approximately parallel and the intercept values, D_o, will increase as the pump flow range decreases.

(9) If the calibration has been performed carefully, the calculated values from the equation will be within ±0.50 percent of the measured value of V_o. Values of M will vary from one pump to another, but values of D_o for pumps of the same make, model, and range should agree within ±3 percent of each other. Particulate influx from use will cause the pump slip to decrease as reflected by lower values for M. Calibrations should be performed at pump startup and after major maintenance to assure the stability of the pump slip rate. Analysis of mass injection data will also reflect pump slip stability.

(b) *CFV calibration.* (1) Calibration of the Critical Flow Venturi (CFV) is based upon the flow equation for a critical venturi. Gas flow is a function of inlet pressure and temperature:

$$Q_s = \frac{K_v P}{\sqrt{T}}$$

Where:
Q_s=Flow
K_v=Calibration coefficient
P=Absolute pressure
T=Absolute temperature

The calibration procedure described below establishes the value of the calibration coefficient at measured values of pressure, temperature and air flow.

(2) The manufacturer's recommended procedure shall be followed for calibrating electronic portions of the CFV.

(3) Measurements necessary for flow calibration are as follows:

Calibration data measurements

Parameter	Symbol	Units	Tolerances
Barometric pressure (corrected)	P_B	kPa (in. Hg)	±0.03 kPa (±0.01 in. Hg).
Air temperature, flowmeter	ETI	°C (°F)	±0.15° C (±0.27° F).
Pressure depression upstream of LFE	EPI	kPa (in. H_2O)	±0.01 kPa (±0.05 in. H_2O).
Pressure drop across LFE matrix	EDP	kPa (in. H_2O)	±0.001 kPa (±0.005 in. H_2O).
Air flow	Q_s	m^3 min. (ft^3 min)	±0.5%.
CFV inlet depression	PPI	kPa (in. fluid)	±0.02 kPa (±0.05 in. fluid).
Temperature at venturi inlet	T_v	°C (°F)	±0.25° C (±0.45° F).
Specific gravity of manometer fluid (1.75 oil)	Sp. Gr.		

(4) Set up equipment as shown in Figure F78–6 and check for leaks. Any leaks between the flow measuring device and the critical flow venturi will seriously affect the accuracy of the calibration.

(5) Set the variable flow restrictor to the open position, start the blower and allow the system to stabilize. Record data from all instruments.

(6) Vary the flow restrictor and make at least 8 readings across the critical flow range of the venturi.

(7) *Data analysis.* The data recorded during the calibration are to be used in the following calculations:

(i) The air flow rate, Q_s, at each test point is calculated from the flow meter data using the manufacturer's prescribed method.

(ii) Calculate values of the calibration coefficient for each test point:

$$K_v = \frac{Q_s \sqrt{T_v}}{P_v}$$

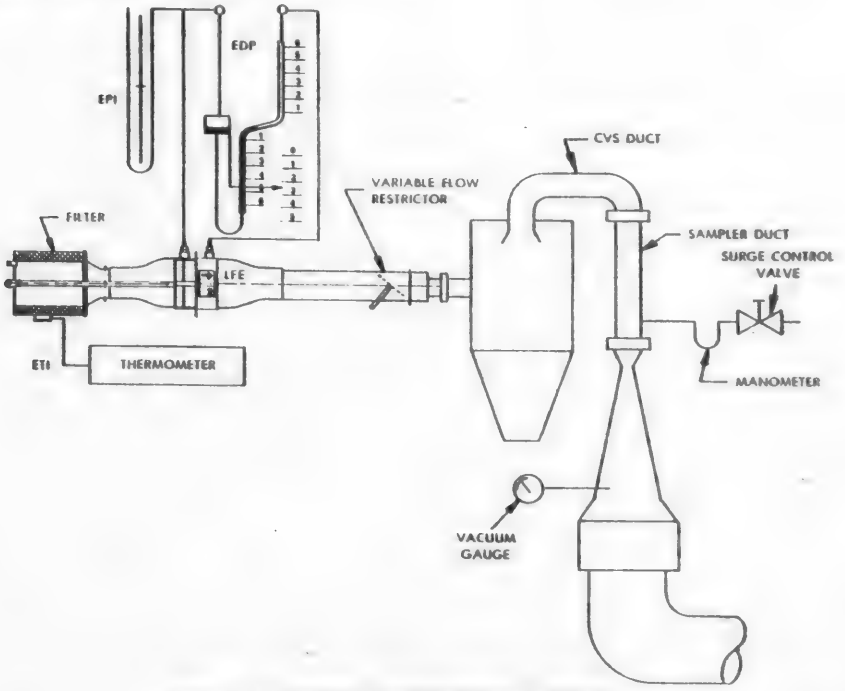


FIGURE F78-6 CFV-CVS CALIBRATION CONFIGURATION

Where:

Q_s=Flow rate, standard conditions are 20° C, 101.325 kPa (68° F, 29.92 in. Hg)
T_v=Temperature at venturi inlet, K(R).
P_v=Pressure at venturi inlet, kPa (mm Hg)=P_B−PPI

for English units P_v=P_B−PPI (SP. GR./13.57).

Where:

PPI=Venturi inlet pressure depression, kPa (in. fluid).
SP. GR.=Specific gravity of manometer fluid, relative to water.

(iii) Plot K_v as a function of venturi inlet depression. For sonic flow, K_v will have a relatively constant value. As pressure decreases (vacuum increases), the venturi becomes unchoked and K_v decreases (is no longer constant). See Figure F78–7.

(iv) For a minimum of 8 points in the critical region calculate an average K_v and the standard deviation.

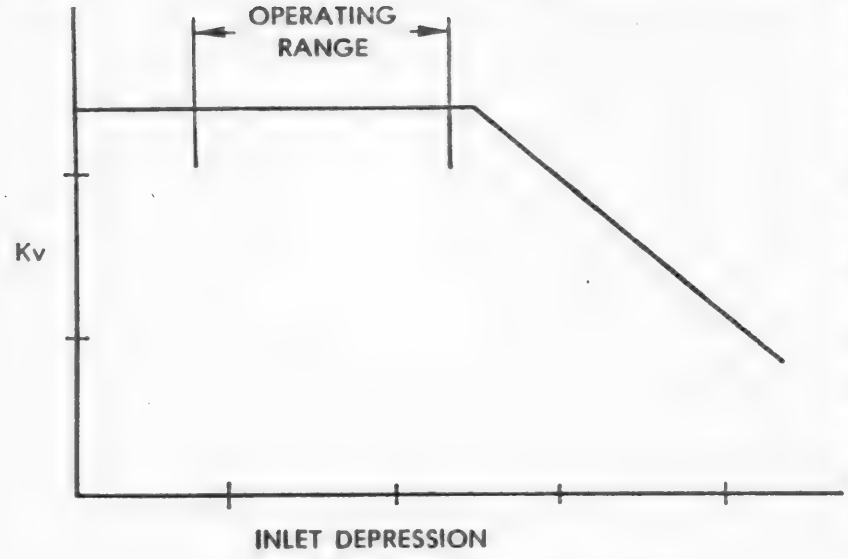


FIGURE F78-7 —SONIC FLOW CHOKING

(v) If the standard deviation exceeds 0.3 percent of the average K_v take corrective action.

(c) *CVS System Verification.* The following "gravimetric" technique can be used to verify that the CVS and analytical instruments can accurately measure a mass of gas that has been injected into the system. (Verification can also be accomplished by constant flow metering using critical flow orifice devices.)

(1) Obtain a small cylinder that has been charged with pure propane or carbon monoxide gas (caution—carbon monoxide is poisonous).

(2) Determine a reference cylinder weight to the nearest 0.01 grams.

(3) Operate the CVS in the normal manner and release a quantity of pure propane or carbon monoxide into the system during the sampling period (approximately 5 minutes).

(4) The calculations of § 86.544 are performed in the normal way except in the case of propane. The density of propane (0.6109 kg/m³/carbon atom (17.30 g/ft³/carbon atom)) is used in place of the density of exhaust hydrocarbons. In the case of carbon monoxide, the density of 1.164 kg/m³ (32.97 g/ft³) is used.

(5) The gravimetric mass is subtracted from the CVS measured mass and then divided by the gravimetric mass to determine the percent accuracy of the system.

(6) The cause for any discrepancy greater than ±2 percent must be found and corrected.

§ 86.520 [Reserved]

§ 86.521–78 Hydrocarbon analyzer calibration.

(a) Initial and periodic optimization of detector response. Prior to its introduction into service and at least annually thereafter the FID hydrocarbon analyzer shall be adjusted for optimum hydrocarbon response. Alternate methods yielding equivalent results may be used if approved in advance by the Administrator.

(1) Follow the manufacturer's instructions for instrument startup and basic operating adjustment using the appropriate fuel and zero grade air.

(2) Optimize on the most common operating range. Introduce into the analyzer, a propane in air mixture with a propane concentration equal to approximately 90% of the most common operating range.

(3) Select an operating fuel flow rate that will give near maximum response and least variation in response with minor fuel flow variations.

(4) To determine the optimum air flow, use the fuel flow setting determined above and vary air flow.

(5) After the optimum flow rates have been determined, they are recorded for future reference.

(b) Initial and periodic calibration. Prior to its introduction into service and monthly thereafter the FID hydrocarbon analyzer shall be calibrated on all normally used instrument ranges. Use the same flow rate as when analyzing samples.

(1) Adjust analyzer to optimize performance.

(2) Zero the hydrocarbon analyzer with zero grade air.

(3) Calibrate on each normally used operating range with propane in air calibration gases having nominal concentrations of 50 and 100 percent of that range. Additional calibration points may be generated.

§ 86.522–78 Carbon monoxide analyzer calibration.

(a) Initial and periodic interference check. Prior to its introduction into service and annually thereafter the NDIR carbon monoxide analyzer shall be checked for response to water vapor and CO_2:

(1) Follow the manufacturer's instructions for instrument startup and operation. Adjust the analyzer to optimize performance on the most sensitive range.

(2) Zero the carbon monoxide analyzer with either zero grade air or zero grade nitrogen.

(3) Bubble a mixture of 3% CO_2 in N_2 through water at room temperature and record analyzer response.

(4) An analyzer response of more than 1% of full scale for ranges above 300 ppm full scale or of more than 3 ppm on ranges below 300 ppm full scale will require corrective action. (Use of conditioning columns is one form of corrective action which may be taken.)

(b) Initial and periodic calibration. Prior to its introduction into service and monthly thereafter the NDIR carbon monoxide analyzer shall be calibrated.

(1) Adjust the analyzer to optimize performance.

(2) Zero the carbon monoxide analyzer with either zero grade air or zero grade nitrogen.

(3) Calibrate on each normally used operating range with carbon monoxide in N_2 calibration gases having nominal concentrations of 15, 30, 45, 60, 75, and 90 percent of that range. Additional calibration points may be generated. For each range calibrated, if the deviation from a least-squares best-fit straight line is 2 percent or less of the value at each data point, concentration values may be calculated by use of a single calibration factor for that range. If the deviation exceeds 2 percent at any point, the best-fit non-linear equation which represents the data to within 2 percent of each test point shall be used to determine concentration.

§ 86.523–78 Oxides of nitrogen analyzer calibration.

(a) Prior to its introduction into service and weekly thereafter, if oxides of nitrogen are measured, the chemiluminescent oxides of nitrogen analyzer shall be checked for NO_2 to NO converter efficiency. Figure F78–8 is a reference for the following steps:

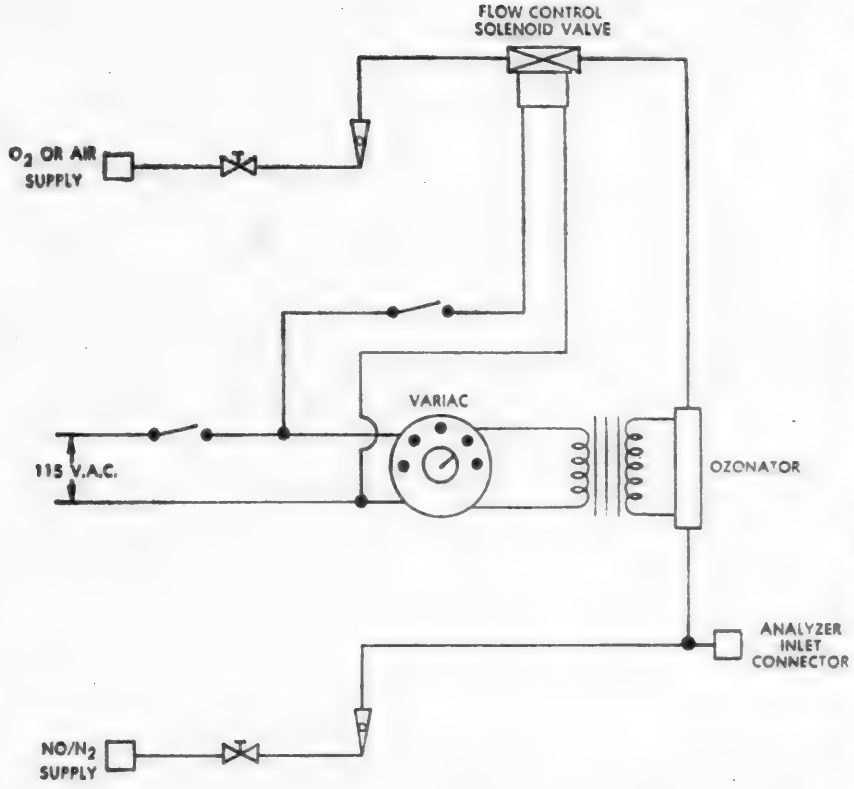
(1) Follow the manufacturer's instructions for instrument startup and operation. Adjust the analyzer to optimize performance.

(2) Zero the oxides of nitrogen analyzer with zero grade air or zero grade nitrogen.

(3) Connect the outlet of the NOx generator to the sample inlet of the oxides of nitrogen analyzer which has been set to the most common operating range.

(4) Introduce into the NOx generator analyzer-system a NO in nitrogen (N_2) mixture with a NO concentration equal to approximately 80 percent of the most common operating range. The NO_2 content of the gas mixture shall be less than 5 percent of the NO concentration.

(5) With the oxides of nitrogen analyzer in the NO mode, record the concentration of NO indicated by the analyzer.



(SEE FIG F78-3 FOR SYMBOL LEGEND)

FIGURE F78-8—NOx CONVERTER EFFICIENCY DETECTOR

(6) Turn on the NOx generator O_2 (or air) supply and adjust the O_2 (or air) flow rate so that the NO indicated by the analyzer is about 10 percent less than indicated in step 5. Record the concentration of NO in this NO+O_2 mixture.

(7) Switch the NOx generator to the generation mode and adjust the generation rate so that the NO measured on the analyzer is 20 percent of that measured in step 5. There must be at least 10 percent unreacted NO at this point. Record the concentration of residual NO.

(8) Switch the oxides of nitrogen analyzer to the NOx mode and measure total NOx. Record this value.

(9) Switch off the NOx generation but maintain gas flow through the system. The oxides of nitrogen analyzer will indicate the NOx in the NO+O_2 mixture. Record this value.

(10) Turn off the NOx generator O_2 (or air) supply. The analyzer will now indicate the NOx in the original NO in N_2 mixture. This value should be no more than 5 percent above the value indicated in step 4.

(11) Calculate the efficiency of the NOx converter by substituting the concentrations obtained into the following equation:

$$\text{Percent Eff.} = \left(1 + \frac{a-b}{c-d}\right) \times 100$$

where:
a = concentration obtained in step 8.
b = concentration obtained in step 9.
c = concentration obtained in step 6.
d = concentration obtained in step 7.

If converter efficiency is not greater than 90 percent corrective action will be required.

(b) Initial and periodic calibration. Prior to its introduction into service and monthly thereafter, if oxides of nitrogen are measured, the chemiluminescent oxides of nitrogen analyzer shall be calibrated on all normally used instrument ranges. Use the same flow rate as when analyzing samples. Proceed as follows:

(1) Adjust analyzer to optimize performance.

(2) Zero the oxides of nitrogen analyzer with zero grade air or zero grade nitrogen.

(3) Calibrate on each normally used operating range with NO in N_2 calibration gases with nominal concentrations of 50 and 100 percent of that range. Additional calibration points may be generated.

§ 86.524–78 Carbon dioxide analyzer calibration.

(a) Prior to its introduction into service and monthly thereafter the NDIR carbon dioxide analyzer shall be calibrated:

(1) Follow the manufacturer's instructions for instrument startup and operation. Adjust the analyzer to optimize performance.

(2) Zero the carbon dioxide analyzer with either zero grade air or zero grade nitrogen.

(3) Calibrate on each normally used operating range with carbon dioxide in N_2 calibration gases with nominal concentrations of 15, 30, 45, 60, 75, and 90 percent of that range. Additional calibration points may be generated. For each range calibrated, if the deviation from a least-squares best-fit straight line is 2 percent or less of the value at each data point, concentration values may be calculated by use of a single calibration factor for that range. If the deviation exceeds 2 percent at any point, the best-fit non-linear equation which represents the data to within 2 percent of each test point shall be used to determine concentration.

§ 86.525 [Reserved]

§ 86.526–78 Calibration of other equipment.

(a) Other test equipment used for testing shall be calibrated as often as required by the manufacturer or as necessary according to good practice.

§ 86.527–78 Test procedures, overview.

The procedures described in this and subsequent sections are used to determine the conformity of vehicles with the standards set forth in Subpart E.

(a) The overall test consists of prescribed sequences of fueling, parking, and operating conditions.

(b) The exhaust emission test is designed to determine hydrocarbon, carbon monoxide, and oxides of nitrogen mass emissions while simulating an average trip in an urban area. The test consists of engine startups and vehicle operation on a chassis dynamometer, through a specified driving schedule. A proportional part of the diluted exhaust emissions is collected continuously for subsequent analysis, using a constant volume (variable dilution) sampler.

(c) [Reserved]

(d) Except in cases of component malfunction or failure, all emission control systems installed on or incorporated in a new motor vehicle shall be functioning during all procedures in this Subpart. Maintenance to correct component malfunction or failure shall be authorized in accordance with Subpart E.

§ 86.528–78 Transmissions.

(a) Vehicles equipped with transfer cases, multiple sprockets, etc., shall be tested in the manufacturer's recommended configuration for street or highway use. If more than one configuration is recommended or if the recommendation is deemed unreasonable by the Administrator, the Administrator will specify the test configuration.

(b) All tests shall be conducted with automatic transmissions in "Drive" (highest gear). Automatic clutch-torque converter transmissions may be shifted as manual transmissions at the option of the manufacturer.

(c) Idle modes shall be run with automatic transmissions in "Drive" and the

wheels braked, manual transmission shall be in gear with the clutch disengaged; except first idle, see §§ 86.536 and 86.537.

(d) The vehicle shall be driven with minimum throttle movement to maintain the desired speed. No simultaneous use of brake and throttle shall be permitted.

(e) Acceleration modes shall be driven smoothly. Automatic transmissions shall shift automatically through the normal sequence of gears; manual transmissions shall be shifted as recommended by the manufacturer to the ultimate purchaser (unless determined to be unreasonable by the Administrator) with the operator closing the throttle during each shift and accomplishing the shift with minimum time. If the vehicle cannot accelerate at the specified rate, the vehicle shall be operated with the throttle fully opened until the vehicle speed reaches the value prescribed for that time in the driving schedule.

(f) The deceleration modes shall be run in gear using brakes or throttle as necessary to maintain the desired speed. Manual transmission vehicles shall be downshifted using the same shift points as when upshifting or as recommended by the manufacturer in the vehicle owner's manual. All downshifts shall be made smoothly, disengaging the clutch while shifting and engaging the clutch once the lower gear has been selected. For those modes which require the vehicle to decelerate to zero, manual transmission clutches shall be disengaged when the speed drops below 15 km/h (9.3 mph) for vehicles with engine displacements equal to or greater than 280 cc (17.1 cu. in.), when the speed drops below 10 km/h (6.2 mph) for vehicles with engine displacements less than 280 cc (17.1 cu. in.), when engine roughness is evident, or when engine stalling is imminent.

(g) If downshifting during deceleration is not permitted in the vehicle owner's manual, manual transmissions will be downshifted at the beginning of or during a power mode if recommended by the manufacturer or if the engine obviously is lugging. For those modes which require these vehicles to decelerate to zero, manual transmission clutches shall be disengaged when the speed drops below 25 km/h (15.5 mph) for vehicles with engine displacement equal to or greater than 280 cc (17.1 cu. in.), when the speed drops below 20 km/h (12.4 mph) for vehicles with engine displacements less than 280 cc (17.1 cu. in.), when engine roughness is evident, or when engine stalling is imminent. While the clutch is disengaged and during these deceleration modes, the vehicle shall be shifted to the appropriate gear for starting the next mode.

(h) If shift speeds are not recommended by the manufacturer, manual transmission vehicles shall be shifted as follows:

(1) For Class I and II motorcycles:

Shift	*Speed*
1st to 2d gear	19 km/h (11.8 mi/h).
2d to 3d gear	33 km/h (20.5 mi/h).
3d to 4th gear	44 km/h (27.3 mi/h).
4th to 5th gear	53 km/h (32.9 mi/h).

(2) For Class III motorcycles:

Shift	*Speed*
1st to 2d gear	30 km/h (18.6 mi/h).
2d to 3d gear	45 km/h (28.0 mi/h).
3d to 4th gear	60 km/h (37.3 mi/h).
4th to 5th gear	75 km/h (46.6 mi/h).

(3) Higher gears may be used at the manufacturer's option.

§ 86.529–78 Road load force and inertia weight determination.

(a) Road load as a function of speed is given by the following equation:

$$F = A + CV^2$$

The values for coefficients *A* and *C* and the test inertia are given in Figure F78–9. Velocity (*V*) is in km/h and force (*F*) is in newtons. The forces given by this equation shall be simulated to the best ability of the equipment being used.

(b) The inertia given in Figure F78–9 shall be used. Motorcycles with loaded vehicle mass outside these limits shall be tested at an equivalent inertial mass and road load force specified by the Administrator.

(c) The dynamometer shall be adjusted to reproduce the specified road load as determined by the most recent calibration. Alternatively, the actual vehicle road load can be measured and duplicated:

(1) Make at least 5 replicate coastdowns in each direction from 70 to 60 km/h on a smooth, level, track under balanced wind conditions. The driver must have a mass of 80±10 kg and be in the normal driving position. Record the coastdown time.

Figure F78-9

LOADED VEHICLE MASS (kg)	EQUIVALENT INERTIAL MASS (kg)	FORCE COEFFICIENTS A (N)	C (N/(km/h)²)	FORCE @ 48 km/h (N)	TARGET TIME (sec)	ALLOWABLE TOLERANCE TIME (sec)	SHORTEST TIME (sec)
98 - 105	100	0.0	.0221	94.8	3.95	3.1	2.8
106 - 115	110	0.82	.0227	96.9	3.18	3.4	3.0
116 - 125	120	1.70	.0230	98.8	3.37	3.6	3.2
126 - 135	130	2.57	.0234	100.5	3.60	3.8	3.4
136 - 145	140	3.44	.0237	102.5	3.80	4.0	3.6
146 - 155	150	4.30	.0240	104.2	3.99	4.2	3.8
156 - 165	160	5.19	.0241	105.0	4.10	4.4	4.0
166 - 175	170	6.06	.0244	109.0	4.36	4.6	4.2
176 - 185	180	6.94	.0246	111.0	4.53	4.7	4.3
186 - 195	190	7.81	.0247	113.1	4.69	4.9	4.5
196 - 205	200	8.69	.0250	115.1	4.85	5.1	4.6
206 - 215	210	9.56	.0250	117.1	5.00	5.2	4.8
216 - 225	220	10.43	.0252	119.2	5.15	5.4	4.9
226 - 235	230	11.31	.0250	121.2	5.30	5.5	5.1
236 - 245	240	12.18	.0253	123.2	5.43	5.7	5.2
246 - 255	250	13.06	.0256	125.2	5.57	5.8	5.4
256 - 265	260	13.93	.0258	127.2	5.70	5.9	5.5
266 - 275	270	14.80	.0271	129.3	5.82	6.1	5.6
276 - 285	280	15.68	.0273	131.3	5.95	6.2	5.7
286 - 295	290	16.55	.0277	133.3	6.05	6.3	5.8
296 - 305	300	17.43	.0279	135.4	6.18	6.4	6.0
306 - 315	310	18.30	.0282	137.5	6.29	6.5	6.1
316 - 325	320	19.17	.0285	139.5	6.40	6.6	6.2
326 - 335	330	20.05	.0288	141.6	6.50	6.7	6.3
336 - 345	340	20.92	.0290	143.6	6.60	6.8	6.4
346 - 355	350	21.80	.0293	145.6	6.70	6.9	6.5
356 - 365	360	22.67	.0296	147.7	6.80	7.0	6.6
366 - 375	370	23.54	.0299	149.7	6.89	7.1	6.7
376 - 385	380	24.42	.0301	151.7	6.98	7.2	6.8
386 - 395	390	25.29	.0304	153.8	7.07	7.3	6.9
396 - 405	400	26.17	.0307	155.8	7.16	7.4	6.9
406 - 415	410	27.04	.0310	157.8	7.24	7.5	7.0
416 - 425	420	27.91	.0312	159.9	7.33	7.6	7.1
426 - 435	430	28.79	.0315	161.9	7.41	7.6	7.2
436 - 445	440	29.66	.0317	163.7	7.49	7.7	7.3
446 - 455	450	30.54	.0319	164.9	7.61	7.8	7.4
456 - 465	460	31.41	.0319	166.0	7.73	8.0	7.5
466 - 475	470	32.28	.0319	167.1	7.84	8.1	7.6
476 - 485	480	33.16	.0320	168.3	7.95	8.2	7.7
486 - 495	490	34.03	.0320	169.4	8.06	8.3	7.8
496 - 505	500	34.90	.0321	170.5	8.17	8.4	7.9
506 - 515	510	35.78	.0322	171.7	8.28	8.5	8.0
516 - 525	520	36.65	.0322	172.8	8.39	8.6	8.2
526 - 535	530	37.53	.0323	173.9	8.49	8.7	8.3
536 - 545	540	38.40	.0323	175.1	8.60	8.8	8.4
546 - 555	550	39.27	.0324	176.2	8.70	9.0	8.5
556 - 565	560	40.15	.0325	177.3	8.80	9.1	8.6
566 - 575	570	41.02	.0325	178.5	8.90	9.2	8.7
576 - 585	580	41.90	.0326	179.6	9.00	9.3	8.8
586 - 595	590	42.77	.0327	180.8	9.10	9.4	8.9
596 - 605	600	43.64	.0327	181.9	9.19	9.5	8.9
606 - 615	610	44.52	.0328	183.0	9.29	9.5	9.0
616 - 625	620	45.39	.0328	184.2	9.38	9.6	9.1
626 - 635	630	46.27	.0329	185.3	9.47	9.7	9.2
636 - 645	640	47.14	.0330	186.4	9.56	9.8	9.3
646 - 655	650	48.01	.0330	187.6	9.65	9.9	9.4
656 - 665	660	48.89	.0331	188.7	9.74	10.0	9.5
666 - 675	670	49.76	.0332	189.8	9.83	10.1	9.6
676 - 685	680	50.64	.0332	191.0	9.92	10.2	9.7
686 - 695	690	51.51	.0333	192.1	10.01	10.3	9.8
696 - 705	700	52.38	.0333	193.2	10.09	10.4	9.8
706 - 715	710	53.26	.0334	194.4	10.17	10.4	9.9
716 - 725	720	54.13	.0335	195.5	10.26	10.5	10.0
726 - 735	730	55.01	.0335	196.6	10.34	10.6	10.1
736 - 745	740	55.88	.0336	197.8	10.42	10.7	10.2
746 - 755	750	56.75	.0336	198.9	10.50	10.8	10.2
756 - 760	760	57.63	.0337	200.1	10.58	10.9	10.3

(2) Average the coastdown times. Adjust the dynamometer load so that the coastdown time is duplicated with the vehicle and driver on the dynamometer.

(3) Alternate procedures may be used if approved in advance by the Administrator.

§ 86.530–78 Test sequence, general requirements.

(a) Ambient temperature levels encountered by the test vehicle throughout the test sequence shall not be less than 20° C (68° F) nor more than 30° C (86° F). The vehicle shall be approximately level during the emission test to prevent abnormal fuel distribution.

§ 86.531–78 Vehicle preparation.

(a) The manufacturer shall provide additional fittings and adapters, as required by the Administrator * * *, such as * * * to accommodate a fuel drain at the lowest point possible in the tank(s) as installed on the vehicle and to provide for exhaust sample collection.

§ 86.532–78 Vehicle preconditioning.

(a) The vehicle shall be moved to the test area and the following operations performed:

(1) The fuel tank(s) shall be drained through the provided fuel tank(s) drain(s) and charged with the specified test fuel, § 86.513, to half the tank(s) capacity.

(2) The vehicle shall be placed, either by being driven or pushed, on a dynamometer and operated through one Urban Dynamometer Driving Schedule test procedure (see § 86.515 and Appendix I). The vehicle need not be cold, and may be used to set dynamometer horsepower.

(b) Within five (5) minutes of completion of preconditioning, the vehicle shall be removed from the dynamometer and may be driven or pushed to the soak area to be parked. The vehicle shall be stored for not less than the following times prior to the cold start exhaust test.

	hrs.
Class I	6
Class II	8
Class III	12

In no case shall the vehicle be stored for more than 36 hours prior to the cold start exhaust test.

§ 86.533 [Reserved]

§ 86.534 [Reserved]

§ 86.535–78 Dynamometer procedure.

(a) The dynamometer run consists of two tests, a "cold" start test and a "hot" start test following the "cold" start by 10 minutes. Engine startup (with all accessories turned off), operation over the driving schedule, and engine shutdown make a complete cold start test. Engine startup and operation over the first 505 seconds of the driving schedule complete the hot start test. The exhaust emissions are diluted with ambient air and a continuously proportional sample is collected for analysis during each phase. The composite samples collected in bags are analyzed for hydrocarbons, carbon monoxide, carbon dioxide, and, optionally, for oxides of nitrogen. A parallel sample of the dilution air is similarly analyzed for hydrocarbon, carbon monoxide, carbon dioxide, and, optionally, for oxides of nitrogen.

(b) [Reserved]

(c) The vehicle speed, as measured from the dynamometer rolls, shall be used. A speed vs. time recording, as evidence of dynamometer test validity, shall be supplied on request of the Administrator.

(d) Practice runs over the prescribed driving schedule may be performed at test points, provided an emission sample is not taken, for the purpose of finding the minimum throttle action to maintain the proper speed-time relationship, or to permit sampling system adjustments.

(e) The drive wheel tires must be inflated to the manufacturer's recommended pressure, ±15 kPa (±2.2 psi). The drive wheel tire pressure shall be reported with the test results.

(f) If the dynamometer has not been operated during the two hour period immediately preceding the test, it shall be warmed up for 15 minutes by operating at 50 km/h (31.1 mph) using a non-test vehicle, or as recommended by the dynamometer manufacturer.

(g) If the dynamometer horsepower must be adjusted manually, it shall be set within one hour prior to the exhaust emissions test phase. The test vehicle shall not be used to make this adjustment. Dynamometers using automatic control of preselectable power settings may be set anytime prior to the beginning of the emissions test.

(h) The driving distance, as measured by counting the number of dynamometer roll revolutions, shall be determined for the transient cold start, stabilized cold start, and transient hot start phases of the test.

§ 86.536–78 Engine starting and restarting.

(a) (1) The engine shall be started according to the manufacturer's recommended starting procedures. The initial 20 second idle period shall begin when the engine starts.

(2) *Choke operation.* (i) Vehicles equipped with automatic chokes shall be operated according to the instructions in the manufacturer's operating instructions or owner's manual including choke setting and "kick-down" from cold fast idle. The transmission shall be placed in gear 15 seconds after the engine is started. If necessary, braking may be employed to keep the drive wheels from turning.

(ii) Vehicles equipped with manual chokes shall be operated according to the manufacturer's operating instructions or owner's manual. Where times are provided in the instructions, the Administrator may specify the specific point for operation, within 15 seconds of the recommended time.

(3) The operator may use the choke, throttle etc. where necessary to keep the engine running.

(4) If the manufacturer's operating instructions or owner's manual do not specify a warm engine starting procedure, the engine (automatic and manual choke engines) shall be started by opening the throttle about half way and cranking the engine until it starts.

(b) [Reserved]

(c) If, during the cold start, the vehicle does not start after 10 seconds of cranking, or ten cycles of the manual starting mechanism, cranking shall cease and the reason for failure to start determined. The revolution counter on the constant volume sampler shall be turned off and the sample solenoid valves placed in the "standby" position during this diagnostic period. In addition, either the CVS blower shall be turned off or the exhaust tube disconnected from the tailpipe during the diagnostic period.

(1) If failure to start is an operational error, the vehicle shall be rescheduled for testing from a cold start. If failure to start is caused by vehicle malfunction, corrective action (following the unscheduled maintenance provisions) of less than 30 minutes duration may be taken and the test continued. The sampling system shall be reactivated at the same time cranking is started. When the engine starts, the driving schedule timing sequence shall begin. If failure to start is caused by vehicle malfunction and the vehicle cannot be started, the test shall be voided, the vehicle removed from the dynamometer, corrective action taken (following the unscheduled maintenance provisions), and the vehicle rescheduled for test. The reason for the malfunction (if determined) and the corrective action taken shall be reported.

(2) If the vehicle does not start during the hot start after ten seconds of cranking, or ten cycles of the manual starting mechanism, cranking shall cease, the test shall be voided, the vehicle removed from the dynamometer, corrective action taken in accordance with § 86.428 or § 86.429, and the vehicle rescheduled for test. The reason for the malfunction (if determined) and the corrective action taken shall be reported.

(d) If the engine "false starts", the operator shall repeat the recommended starting procedure (such as resetting the choke, etc.)

(e) *Stalling.* (1) If the engine stalls during an idle period, the engine shall be restarted immediately and the test continued. If the engine cannot be started soon enough to allow the vehicle to follow the next acceleration as prescribed, the driving schedule indicator shall be stopped. When the vehicle restarts, the driving schedule indicator shall be reactivated.

(2) If the engine stalls during some operating mode other than idle, the driving schedule indicator shall be stopped, the vehicle shall then be restarted and accelerated to the speed required at that point in the driving schedule and the test continued. During acceleration to this point, shifting shall be performed in accordance with § 86.528.

(3) If the vehicle will not restart within one minute, the test shall be

voided, the vehicle removed from the dynamometer, corrective action taken, and the vehicle rescheduled for test. The reason for the malfunction (if determined) and the corrective action taken shall be reported.

§ 86.537–78 Dynamometer test runs.

(a) The vehicle shall be allowed to stand with the engine turned off (see § 86.532 for required time). The vehicle shall be stored prior to the emission test in such a manner that precipitation (e.g., rain or dew) does not occur on the vehicle. The complete dynamometer test consists of a cold start drive of 12.0 km (7.5 miles), (10.9 km (6.8 miles) for Class I motorcycles) and simulates a hot start drive of 12.0 km (7.5 miles), (10.9 km (6.8 miles) for Class I motorcycles). The vehicle is allowed to stand on the dynamometer during the 10 minute period between the cold and hot start tests. The cold start is divided into two periods. The first period, representing the cold start "transient" phase, terminates at the end of the deceleration which is scheduled to occur at 505 seconds of the driving schedule. The second period, representing the "stabilized" phase, consists of the remainder of the driving schedule including engine shutdown. The hot start test similarly consists of two periods. The period, representing the hot start "transient" phase, terminates at the same point in the driving schedule at the first period of the cold start test. The second period of the hot start test, "stabilized" phase, is assumed to be identical to the second period of the cold start test. Therefore, the hot start test terminates after the first period (505 seconds) is run.

(b) The following steps shall be taken for each test:

(1) Place drive wheel of vehicle on dynamometer without starting engine.

(2) Activate vehicle cooling fan system.

(3) With the sample selector valves in the "standby" position, connect evacuated sample collection bags to the dilute exhaust and dilution air sample collection systems.

(4) Start the Constant Volume Sampler (if not already on), the sample pumps, and the temperature recorder. (The heat exchanger of the constant volume sampler, if used, should be preheated to operating temperature before the test begins).

(5) Adjust the sample flow rates to the desired flow rate (minimum of 80 cc/s (10.2 ft^3/hr) for PDP–CVS) and set the gas flow measuring devices to zero.

NOTE.—CFV–CVS sample flowrate is fixed by the venturi design.

(6) Attach the flexible exhaust tube to the vehicle tailpipe(s).

(7) Start the gas flow measuring device, position the sample selector valves to direct the sample flow into the "transient" exhaust sample bag and the "transient" dilution air sample bag and start cranking the engine.

(8) Fifteen seconds after the engine starts, place the transmission in gear.

(9) Twenty seconds after the engine starts, begin the initial vehicle acceleration of the driving schedule.

(10) Operate the vehicle according to the dynamometer driving schedule (§ 86.515).

(11) At the end of the deceleration which is scheduled to occur at 505 seconds, simultaneously switch the sample flows from the "transient" bags to the "stabilized" bags, switch off gas flow measuring device No. 1 and start gas flow measuring device No. 2. Before the acceleration, which begins at 510 seconds, record the roll revolutions. As soon as possible, transfer the "transient" exhaust and dilution samples to the analytical system and process the samples according to § 86.540 obtaining a stabilized reading of the exhaust sample on all analyzers within 20 minutes of the end of the sample collection phase of the test.

(12) Turn engine off 2 seconds after the end of the last deceleration (at 1,369 seconds).

(13) Five seconds after the engine stops running, simultaneously turn off gas flow measuring device No. 2 and position the sample selector valves to the "standby" position. Record the measured roll revolutions. As soon as possible, transfer the "stabilized" exhaust and dilution air samples to the analytical system and process the samples according to § 86.540 obtaining a stabilized reading of the exhaust sample on all analyzers within 20 minutes of the end of the sample collection phase of the test.

(14) Immediately after the end of the sample period turn off the vehicle cooling fan system.

(15) Turn off the CVS or disconnect the exhaust tube from the tailpipe of the vehicle.

(16) Repeat the steps in paragraphs (b)(2) through (10) of this section for the hot start test, except only one evacuated sample bag is required for sampling exhaust gas and one for dilution air. The step in paragraph (b)(7) of this section shall begin between 9 and 11 minutes after the end of the sample period for the cold start test.

(17) At the end of the deceleration which is scheduled to occur at 505 seconds, simultaneously turn off gas flow measuring device No. 1 and position the sample selector valve to the "standby" position. (Engine shutdown is not part of the hot start test sample period.) Record the measured roll revolutions.

(18) As soon as possible, transfer the hot start "transient" exhaust and dilution air samples to the analytical system and process the samples according to § 86.540 obtaining a stabilized reading of the exhaust sample on all analyzers within 20 minutes of the end of the sample collection phase of the test.

(19) Disconnect the exhaust tube from the vehicle tailpipe(s) and remove vehicle from dynamometer.

(20) The constant volume sampler may be turned off, if desired.

(21) Continuous monitoring of exhaust emissions will not normally be allowed. Specific written approval must be obtained from the Administrator for continuous monitoring of exhaust emissions.

§ 86.538 [Reserved]

§ 86.539 [Reserved]

§ 86.540–78 Exhaust sample analysis.

The following sequence of operations shall be performed in conjunction with each series of measurements:

(a) Zero the analyzers and obtain a stable zero reading. Recheck after tests.

(b) Introduce span gases and set instrument gains. In order to avoid corrections, span and calibrate at the same flow rates used to analyze the test sample. Span gases should have concentrations equal to 75 to 100 percent of full scale. If gain has shifted significantly on the analyzers, check the calibrations. Show actual concentrations on chart.

(c) Check zeros; repeat the procedure in paragraphs (a) and (b) of this section if required.

(d) Check flowrates and pressures.

(e) Measure HC, CO, CO_2, and, optionally, NOx concentrations of samples.

(f) [Reserved]

(g) Check zero and span points. If difference is greater than 2 percent of full scale, repeat the procedure in paragraphs (a) through (f) of this section.

§ 86.541 [Reserved]

§ 86.542–78 Records required.

The following information shall be recorded with respect to each test:

(a) Test number.

(b) System or device tested (brief description).

(c) Date and time of day for each part of the test schedule.

(d) Instrument operator.

(e) Driver or operator.

(f) *Vehicle:* Make, Vehicle identification number, Model year, Transmission type, Odometer reading, Engine displacement, Engine family, Emission control system, Recommended Idle RPM, Nominal fuel tank capacity, Inertial loading, Actual curb mass recorded at 0 kilometres, and Drive wheel tire pressure.

(g) *Dynamometer serial number:* As an alternative to recording the dynamometer serial number, a reference to a vehicle test cell number may be used, with the advance approval of the Administrator, provided the test cell records show the pertinent information.

(h) All pertinent instrument information such as tuning—gain—serial number—detector number—range. As an alternative, a reference to a vehicle test cell number may be used, with the advance approval of the Administrator, provided test cell calibration records show the pertinent instrument information.

(i) *Recorder charts:* Identify zero, span, exhaust gas, and dilution air sample traces.

(j) Test cell barometric pressure, ambient temperature and humidity.

NOTE.—A central laboratory barometer may be used; provided that individual test cell barometric pressures are shown to be within ±0.1 percent of the barometric pressure at the central barometer location.

(k) [Reserved]

(l) Pressure of the mixture of exhaust and dilution air entering the CVS metering device, the pressure increase across the device, and the temperature at the inlet. The temperature may be recorded continuously or digitally to determine temperature variations.

(m) The number of revolutions of the positive displacement pump accumulated during each test phase while exhaust samples are being collected. The number of standard cubic metres metered by a critical flow venturi during each test phase would be the equivalent record for a CFV–CVS.

(n) The humidity of the dilution air.

NOTE.—If conditioning columns are not used (see § 86.522 and § 86.544) this measurement can be deleted. If the conditioning columns are used and the dilution air is taken from the test cell, the ambient humidity can be used for this measurement.

§ 86.543 [Reserved]

§ 86.544–78 Calculations; exhaust emissions.

The final reported test results, with oxides of nitrogen being optional, shall be computed by use of the following formulae: (The results of all emission tests shall be rounded, using the "Rounding-Off Method" specified in ASTM E 29–67, to the number of places to the right of the decimal point indicated by expressing the applicable standard to three significant figures.)

(a)

$$Ywm = 0.43 [(Yct + Ys)/(Dct + Ds)] + 0.57 [(Yht + Ys)/(Dht + Ds)].$$

where:

Ywm=Weighted mass emissions of CO_2 or of each pollutant, i.e., HC, CO, or NOx, in grams per vehicle kilometre.

Yct=Mass emissions as calculated from the "transient" phase of the cold start test, in grams per test phase.

Yht=Mass emissions as calculated from the "transient" phase of the hot start test, in grams per test phase.

Ys=Mass emissions as calculated from the "stabilized" phase of the cold start test, in grams per test phase.

Dct=The measured driving distance from the "transient" phase of the cold start test, in kilometres.

Dht=The measured driving distance from the "transient" phase of the hot start test, in kilometres.

Ds=The measured driving distance from the "stabilized" phase of the cold start test, in kilometres.

(b) The mass of each pollutant for each phase of both the cold start test and the hot start test is determined from the following:

(1) Hydrocarbon mass:

HCmass=Vmix X DensityHC X (HCconc/1,000,000).

(2) Oxides of nitrogen mass:

NOxmass=Vmix X DensityNO2 X (NOxconc X Kh/1,000,000).

(3) Carbon monoxide mass:

COmass=Vmix X DensityCO X (COconc/1,000,000).

(4) Carbon dioxide mass:

CO2mass=Vmix X DensityCO2 X (CO2 conc/100).

(c) Meaning of symbols:

HCmass=Hydrocarbon emissions, in grams per test phase.

DensityHC=Density of hydrocarbon in the exhaust gas, 0.5767 kg/m³/carbon atom (16.33 g/ft³/carbon atom), assuming an average carbon to hydrogen ratio of 1:1.85, at 20°C (68°F) and 101.325 kPa (760 mm Hg) pressure.

HCconc=Hydrocarbon concentration of the dilute exhaust sample corrected for background, in ppm carbon equivalent, i.e., equivalent propane X3.

HCconc=HCe-HCd (1–1/DF).

where:

HCe=Hydrocarbon concentrations of the dilute exhaust sample as measured, in ppm carbon equivalent. (Propane ppm x 3.)

HCd=Hydrocarbon concentration of the dilution air as measured, in ppm carbon equivalent. (Propane ppm x 3.)

NOxmass=Oxides of nitrogen emissions, in grams per test phase.

Density NO2=Density of oxides of nitrogen in the exhaust gas, assuming they are in the form of nitrogen dioxide, 1.913 kg/m³ (54.16 g/ft³), at 20° C (68° F) and 101.325 kPa (760 mm Hg) pressure.

NOxconc=Oxides of nitrogen concentration of the dilute exhaust sample corrected for background, in ppm.

NOxconc=NOxe-NOxd (1–1/DF).

where:

NOxe=Oxides of nitrogen concentration of the dilute exhaust sample as measured, in ppm.

NOxd=Oxides of nitrogen concentration of the dilution air as measured, in ppm.

COmass=Carbon monoxide emissions, in grams per test phase.

Density CO=Density of carbon monoxide, 1.164 kg/m³ (32.97 g/ft³), at 20° C (68° F) and 101.325 kPa (760 mm Hg) pressure.

COconc=Carbon monoxide concentration of the dilute exhaust sample corrected for background, water vapor, and CO2 extraction, in ppm.

COconc=COe–COd (1–1/DF).

where:

COe=Carbon monoxide concentration of the dilute exhaust sample volume corrected for water vapor and carbon dioxide extraction, in ppm. The calculation assumes the carbon to hydrogen ratio of the fuel is 1:1.85.

COe=(1–0.01925CO2e—0.000323R) COem.

where:

COem=Carbon monoxide concentration of the dilute exhaust sample as measured, in ppm.

CO2e=Carbon dioxide concentration of the dilute exhaust sample, in mole percent.

R=Relative humidity of the dilution air, in percent (see § 85.478–22 (n)).

COd=Carbon monoxide concentration of the dilution air corrected for water vapor extraction, in ppm.

COd=(1–0.000323R) COdm.

where:

COdm=Carbon monoxide concentration of the dilution air sample as measured, in ppm.

NOTE.—If a CO instrument, which meets the criteria specified in § 86.511 is used and the conditioning column has been deleted, COem can be substituted directly for COe and COdm can be substituted directly for COd.

CO2mass=Carbon dioxide emissions, in grams per test phase.

Density CO2=Density of carbon dioxide, 1.843 kg/m³ (52.20 g/ft³), at 20° C (68° F) and 101.325 kPa (760 mm Hg) pressure.

CO2conc=Carbon dioxide concentration of the dilute exhaust sample corrected for background, in percent.

CO2conc=CO2e–CO2d (1–1/DF) 10^{-4}

Where:

CO2d=Carbon dioxide concentration of the dilution air as measured, in ppm.

DF=13.4/[CO2+(HCe+COe) 10^{-4}]

Vmix=Total dilute exhaust volume in cubic metres per test phase corrected to standard conditions (293.15° K (528° R) and 101.325 kPa (760 mm Hg)).

Vmix=Vo X N [(Pb–Pi) (293.15° K)] ÷ [(101.325 kPa) (Tp)]

Where:

Vo=Volume of gas pumped by the positive displacement pump, in cubic metres per revolution. This volume is dependent on the pressure differential across the positive displacement pump. (See calibration techniques in Appendix III.)

N=Number of revolutions of the positive displacement pump during the test phase while samples are being collected.

Pb=Barometric pressure in kPa.

Pi=Pressure depression below atmospheric measured at the inlet to the positive displacement pump.

Tp=Average temperature of dilute exhaust entering positive displacement pump during test while samples are being collected in degrees Kelvin.

Kh=Humidity correction factor.

Kh=1/[1–0.0329 (H–10.71)]

Where:

H=Absolute humidity in grams of water per kilogram of dry air.

H=[(6.211) Ra X Pd]/[Pb–(Pd X Ra/100)]

Ra=Relative humidity of the ambient air in percent.

Pd=Saturated vapor pressure, in kPa at the ambient dry bulb temperature.

(d) Example calculation of mass emission values for vehicles with engine displacements equal to or greater than 170 cc (10.4 cu. in.):

(1) For the "transient" phase of the cold start test, assume Vo=0.0077934 m³ per revolution; N=12,115; Rb=20.5 percent; Ra=20.5 percent; Pb=99.05 kPa; Pd=3.382 kPa; Pi=9.851 kPa; Tp=309.8 K; HCe 249.75 ppm carbon equivalent; NOxe=38.30 ppm; COem=311.23 ppm; CO2e=0.415 percent; HCd=4.90 ppm; NOxd=0.30 ppm; COdm=8.13 ppm; CO2d=370 ppm; Dct=5.650 km. Then:

Vmix=[(0.0077934) (12,115) (99.05–9.851) (293.15)]/[(101.325) (309.8)]

Vmix=78.651 m³ per test phase.

H=[(6.211) (20.5) (3.382)]/[(99.05)—(3.382) (20.5/100)]

H=4.378 grams H_2O per kg dry air.

Kh=1/[1–0.0329(4.378–10.71)]

Kh=0.8276

COe=[1–0.01925(0.415)—0.000323 (20.5)] 311.23

COe=306.68 ppm.

COd=[1–0.000323 (20.5)] 8.13

COd=8.08 ppm.

DF=13.4/[0.415+(249.75+306.68) 10^{-4}]

DF=28.472

HCconc=249.75–4.90(1–1/28.472)

HCconc=245.02 ppm.

HCmass=(78.651) (576.7) (245.02) 10^{-6}

HCmass=11.114 grams per test phase

NOxconc=38.30–0.30 (1–1/28.472)

NOxconc=38.01 ppm.

NOxmass=(78.651) (1913) (38.01) (0.8276) 10^{-6}

NOxmass=4.733 grams per test phase.

COconc=306.68–8.08 (1–1/28.472)

COconc=298.88 ppm.

COmass=(78.651) (1164) (298.88) 10^{-6}

COmass=27.362 grams per test phase.

CO2conc=0.415-370 (1-1/28.472) 10⁻⁴
CO2conc=0.3793 percent.
CO2mass=(78.651)(1843) (0.3793) 10⁻²
CO2mass=549.81 grams per test phase.

(2) For the "stabilized" portion of the cold start test, assume that similar calculations resulted in HCmass=7.184 grams per test phase; NOxmass=2.154 grams per test phase; COmass=64.541 grams per test phase; and CO2mass=529.52 grams per test phase. Ds=6.070 kilometres.

(3) For the "transient" portion of the hot start test, assume that similar calculations resulted in HCmass=6.122 grams per test phase; NOxmass=7.056 grams per test phase; COmass=34.964 grams per test phase; and CO2mass=480.93 grams per test phase. Dht=5.660 kilometres.

(4) For a 1978 motorcycle with an engine displacement equal to or greater than 170 cc (10.4 cu. in.):

Hcwm=0.43[(11.114+7.184)/(5.6506.070)] + 0.57[(6.122+7.184) / (5.660+6.070)]
HCwm=1.318 grams per vehicle kilometre
NOxwm=0.43[(4.733+2.154) / (5650+6.070)] + 0.57 [(7.056+2.154) / (5.660+6.070)]
NOxwm=0.700 grams per vehicle kilometre.
COwm=0.43[(27.362+64.541) / (5.650+6.070)]+0.57 [(34.964+64.541) / (5.660+6.070)]
COwm=8.207 grams per vehicle kilometre.
CO2wm=0.43[(549.81+529.52) / (5.650+6.070)]+0.57 [(480.93+529.52) / (5.660+6.070)]
CO2wm=88.701 grams per vehicle kilometre.

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[FRL 658-8]

PART 86—CONTROL OF AIR POLLUTION FROM NEW MOTOR VEHICLES AND NEW MOTOR VEHICLE ENGINES: CERTIFICATION AND TEST PROCEDURES

Appendices to Motor Vehicle Emission Regulations

On October 22, 1975, a Notice of Proposed Rule Making (NPRM) was published in the FEDERAL REGISTER (40 FR 49517) setting forth revisions to the Appendices to the motor vehicle emission regulations in Part 85 of Title 40 of the Code of Federal Regulations. The proposed changes were needed to complement the publication of the proposed regulations for the control of exhaust and crankcase emissions from new motorcycles (40 FR 49496). In addition, the appendices were proposed in the International System of Units (SI). Comments by interested parties to the NPRM received prior to 10 February 1976 were considered in the preparation of the final rule making.

Presented below is a list of the major changes to the proposed Appendices which are incorporated for final rule making.

(1) Appendix I, the EPA dynamometer driving schedule, is published as proposed in kilometre per hour units. For the convenience of the user, the driving schedule in miles per hour units is retained. Manufacturers of light duty vehicles or light duty trucks may use either schedule (a) in miles per hour or schedule (b) in kilometres per hour. The tolerance diagram in the corresponding units should be used. Motorcycles with displacements greater than or equal to 170cc (10.4 cu. in.) are to use schedule (b) and motorcycles with displacements less than 170cc are to use schedule (c).

(2) The proposed revision to Appendix II, Procedures for Dynamometer Road Power Calibration, is dropped from the final rule making. A new motorcycle dynamometer calibration procedure, consistent with the revised motorcycle road load force specification, is incorporated in the body of the motorcycle test procedures, Part 86, Subpart F. For light duty vehicles and light duty trucks, the dynamometer calibration procedure has also been incorporated in the body of the applicable test procedures, Part 86, Subpart B.

(3) The revision to Appendix III, Constant Volume Sampler Flow Calibration, is also dropped from the final rulemaking. The calibration procedure, which now includes a method for calibrating a critical flow venturi constant volume sampler, is incorporated in the applicable test procedure sections of Part 86 for motorcycles and for light duty vehicles and light duty trucks.

(4) Appendix IV(b) has been revised to include the durability driving schedule for each of the three motorcycle classes. For laps 1 through 9, the lap speed in SI units has been revised to more nearly equate these schedules with the English unit schedule for light duty vehicles contained in Appendix IV(a). For motorcycles with engine displacements less than 170cc (10.4 cu. in.), the speeds for laps 10 and 11 have been reduced to reflect the inability of some of the smaller motorcycles to achieve the proposed maximum speeds for those laps. For motorcycles with engine displacements equal to or greater than 170cc and less than 280cc (17.1 cu. in.), the speed for lap 11 has been reduced because motorcycles in this class are often designed for dual-purpose operation and may be incapable of attaining the proposed maximum speed for this lap.

(5) Appendix V continues to be reserved.

(6) Appendix VI, Vehicle and Engine Components, is published as proposed.

(7) Appendix VII, Parameters and Specifications, was proposed on December 23, 1974 (39 FR 44246) as part of the Coverage of Motor Vehicle Certificate of Conformity Regulations. It was proposed for motorcycles on October 22, 1975 with certain modifications applicable to motorcycles included. Appendix VII is not included for final rulemaking at this time because of pending resolution of comments. It is anticipated final rulemaking, applicable to all motor vehicles, will be published at a later date.

Comments which were received in response to the NPRM and EPA's detailed analysis of the comments are available for inspection and copying during normal business hours at the U.S. Environmental Protection Agency, Public Information Reference Unit, Room 2922 (EPA Library), 401 M Street, S.W., Washington, D.C. 20460. As provided for in 40 CFR Part 2, a reasonable fee may be charged for copying services.

The Enviromental Protection Agency has determined that this document does not contain a major proposal requiring preparation of an Inflation Impact Statement under Executive Order 11821 and OMB Circular A-107.

The environmental and economic impacts associated with the regulations published of subparts E and F of Title 40, Part 86, Control of Air Pollution From New Motor Vehicles and New Motor Vehicle Engines: Certification and Test Procedures—Emission Regulations for New Motorcycles, have been analyzed. This analysis is contained in the Environmental and Economic Impact Statement, Motorcycle Exhaust and Crankcase Regulations for the 1978 Model Year, December 1976. Single copies of this document are available from the Public Information Center (PM-215), U.S. Environmental Protection Agency, Washington, D.C. 20460.

This Notice of Final Rulemaking is issued under the authority of sections 202, 206, 207, 208, and 301(a) of the Clean Air Act, as amended (42 U.S.C. 1857f-1, 1857f-5, 1857f-5a, 1857f-6, 1857g(a)).

Effective date: This addition to Part 86 becomes effective on February 22, 1977.

Date: December 23, 1976.

JOHN QUARLES,
Acting Administrator.

The following changes are made to the appendices in Part 86 of Chapter I of Title 40 of the Code of Federal Regulations:

1. Appendix I is revised by redesignating Appendix I of Part 85 as part (a) of Appendix I, adding paragraph (a) prior to the schedule listing, and adding paragraphs (b) and (c) to read as follows:

APPENDIX I—URBAN DYNAMOMETER DRIVING SCHEDULES

(a) EPA Urban Dynamometer Driving Schedule for Light Duty Vehicles and Light Duty Trucks.

* * * * *

(b) EPA Urban Dynamometer Driving Schedule for Light Duty Vehicles, Light Duty Trucks, and Motorcycles with engine displacements equal to or greater than 170 cc (10.4 cu. in.).

Speed Versus Time Sequence

Time (seconds):	Speed (kilometres per hour)
0	0
1	0
2	0
3	0
4	0
5	0
6	0
7	0
8	0
9	0
10	0
11	0
12	0
13	0
14	0
15	0
16	0
17	0
18	0
19	0
20	0
21	4.8
22	9.5
23	13.8
24	18.6
25	23.0
26	27.2
27	27.8
28	29.1
29	33.3
30	34.0
31	30.0
32	36.2
33	35.6
34	34.6
35	33.6
36	32.8
37	31.9
38	27.4
39	24.0
40	24.0
41	24.5
42	24.9
43	25.7
44	27.6
45	30.7
46	34.0
47	36.5
48	36.9
49	36.5
50	36.4
51	34.3
52	30.6
53	27.6
54	25.4
55	25.4
56	28.5
57	31.9
58	34.8
59	37.3
60	38.9
61	39.6
62	40.1
63	40.2
64	39.6
65	39.4
66	39.6
67	39.8
68	39.8
69	39.6
70	39.6
71	40.4
72	41.2
73	41.4
74	40.9
75	40.1
76	40.2
77	40.9
78	41.8
79	41.8
80	41.4
81	42.0
82	43.0
83	44.3
84	46.0
85	47.2
86	48.0
87	48.4
88	48.9
89	49.4
90	49.4
91	49.1
92	48.9
93	48.8
94	48.9
95	49.6
96	48.9
97	48.1
98	47.6
99	48.0
100	48.3
101	49.4
102	49.7
103	49.9
104	49.7
105	48.9
106	48.0
107	48.1
108	48.6
109	49.4
110	50.2
111	51.2
112	51.8
113	52.1
114	51.8
115	51.0
116	46.0
117	40.7
118	35.4
119	30.1
120	24.8
121	19.5
122	14.2
123	8.9
124	3.6
125	0
126	0
127	0
128	0
129	0
130	0
131	0
132	0
133	0
134	0
135	0
136	0
137	0
138	0
139	0
140	0
141	0
142	0
143	0
144	0
145	0
146	0
147	0

Time (seconds):	Speed (kilometres per hour)
148	0
149	0
150	0
151	0
152	0
153	0
154	0
155	0
156	0
157	0
158	0
159	0
160	0
161	0
162	0
163	0
164	5.3
165	10.6
166	15.9
167	21.2
168	26.6
169	31.9
170	35.7
171	39.1
172	41.5
173	42.5
174	41.4
175	40.4
176	39.8
177	40.2
178	40.6
179	40.9
180	41.5
181	43.8
182	42.6
183	38.6
184	36.5
185	31.2
186	28.5
187	27.7
188	29.1
189	29.9
190	32.2
191	35.7
192	39.4
193	43.9
194	49.1
195	53.9
196	58.3
197	60.0
198	63.2
199	65.2
200	67.8
201	70.0
202	72.6
203	74.0
204	75.3
205	76.4
206	76.4
207	76.1
208	76.0
209	76.6
210	76.6
211	76.6
212	76.6
213	76.6
214	76.0
215	76.3
216	77.1
217	78.1
218	79.0
219	79.7
220	80.5
221	81.4
222	82.1
223	82.9
224	84.0
225	85.6
226	87.1
227	87.9
228	88.4
229	88.5
230	88.4
231	87.9
232	87.9
233	88.2
234	88.7
235	89.3
236	89.6
237	90.3
238	90.6
239	91.1
240	91.2
241	91.2
242	90.9
243	90.0
244	90.9
245	90.9
246	90.0
247	90.9
248	90.8
249	90.3
250	89.8
251	88.7
252	87.9
253	87.2
254	86.9
255	86.4
256	86.3
257	86.7
258	86.9
259	87.1
260	87.1
261	86.6
262	85.9
263	85.3
264	84.7
265	83.8
266	84.3
267	83.7
268	83.5
269	83.2
270	82.9
271	83.0
272	83.4
273	83.8
274	84.5
275	85.3
276	86.1
277	86.9
278	88.4
279	89.2
280	89.5
281	90.1
282	90.1
283	89.8
284	89.8
285	87.7
286	86.3
287	84.5
288	82.9
289	82.9
290	82.9
291	82.2
292	80.6
293	80.5
294	80.6
295	80.5
296	79.8
297	79.7
298	79.7
299	79.7
300	79.0
301	78.2
302	77.4
303	76.0
304	74.2
305	72.4
306	70.5
307	68.6
308	66.8
309	64.9
310	62.0
311	59.5
312	56.6
313	54.4
314	52.3
315	50.7
316	49.2
317	49.1
318	48.3
319	46.7
320	44.3
321	39.9
322	34.6
323	32.3
324	30.7
325	29.8
326	27.4
327	24.9
328	20.1
329	17.4
330	12.9
331	7.6
332	2.3
333	0
334	0
335	0
336	0
337	0
338	0
339	0
340	0
341	0
342	0
343	0
344	0
345	0
346	0
347	1.6
348	6.9
349	12.2
350	17.5
351	22.9
352	27.8
353	32.2
354	36.2
355	38.1
356	40.6
357	42.8
358	45.2
359	46.3
360	49.6
361	50.9
362	51.7
363	52.8
364	54.1
365	55.5
366	55.7
367	56.2
368	56.0
369	55.5
370	55.8
371	57.1
372	57.9
373	57.9
374	57.9
375	57.9
376	57.9
377	57.9
378	58.1
379	58.6
380	58.7
381	58.6
382	57.9
383	56.5
384	54.9
385	53.9
386	50.5
387	46.7
388	41.4
389	37.0
390	32.7
391	28.2
392	23.3
393	19.3
394	14.0
395	8.7
396	3.4
397	0
398	0
399	0
400	0
401	0
402	0
403	4.2
404	9.5
405	14.8
406	20.1
407	25.4
408	30.7
409	36.0
410	40.2
411	41.2
412	44.3
413	46.7
414	48.3
415	48.4
416	48.3
417	47.8
418	47.2
419	46.3
420	45.1
421	40.2
422	34.9
423	29.6
424	24.3
425	19.0
426	13.7
427	8.4
428	3.1
429	0
430	0
431	0
432	0
433	0
434	0
435	0
436	0
437	0
438	0
439	0
440	0
441	0
442	0
443	0
444	0
445	0
446	0
447	0
448	5.3
449	10.6
450	15.9
451	21.2
452	26.6
453	31.9
454	37.2
455	42.5
456	44.7
457	46.8
458	50.7
459	53.1
460	54.1
461	56.0
462	56.5
463	57.8
464	58.1
465	57.9
466	58.1
467	58.3
468	57.9
469	57.5
470	57.9
471	57.9
472	57.3
473	57.1
474	57.0
475	56.6
476	56.6
477	56.6
478	56.6
479	56.6
480	56.6
481	56.3
482	56.5
483	56.6
484	57.1
485	56.6
486	56.3
487	56.3
488	56.3
489	56.0
490	55.7

491	56.6
492	53.0
493	51.3
494	48.4
495	45.1
496	41.0
497	36.2
498	31.9
499	28.6
500	21.2
501	16.6
502	11.6
503	6.4
504	1.6
505	0
506	0
507	0
508	0
509	0
510	0
511	1.9
512	5.6
513	8.9
514	10.5
515	13.7
516	15.4
517	16.9
518	19.2
519	22.5
520	25.7
521	28.5
522	30.6
523	32.3
524	33.8
525	35.4
526	37.0
527	38.3
528	39.4
529	40.1
530	40.2
531	40.2
532	40.2
533	40.2
534	40.2
535	40.2
536	41.2
537	41.6
538	41.8
539	41.2
540	40.6
541	40.2
542	40.2
543	40.2
544	39.3
545	37.2
546	31.9
547	26.6
548	21.2
549	15.9
550	10.6
551	5.3
552	0
553	0
554	0
555	0
556	0
557	0
558	0
559	0
560	0
561	0
562	0
563	0
564	0
565	0
566	0
567	0
568	0
569	5.3
570	10.6
571	15.9
572	20.9
573	23.5
574	25.7
575	27.4
576	27.4

577	27.4
578	28.2
579	28.5
580	28.5
581	28.2
582	27.4
583	27.2
584	26.7
585	27.4
586	27.5
587	27.4
588	26.7
589	26.6
590	26.6
591	26.7
592	27.4
593	28.3
594	29.8
595	30.9
596	32.5
597	33.8
598	34.0
599	34.1
600	34.8
601	35.4
602	36.0
603	36.2
604	36.2
605	36.2
606	36.5
607	38.1
608	40.4
609	41.8
610	42.6
611	43.5
612	42.0
613	36.7
614	31.4
615	26.1
616	20.8
617	15.4
618	10.1
619	4.8
620	0
621	0
622	0
623	0
624	0
625	0
626	0
627	0
628	0
629	0
630	0
631	0
632	0
633	0
634	0
635	0
636	0
637	0
638	0
639	0
640	0
641	0
642	0
643	0
644	0
645	0
646	3.2
647	7.2
648	12.6
649	16.4
650	20.1
651	22.5
652	24.6
653	28.2
654	31.5
655	33.8
656	36.7
657	37.5
658	39.4
659	40.7
660	41.2
661	41.8
662	42.0

663	43.2
664	43.2
665	42.5
666	42.6
667	42.6
668	41.8
669	41.0
670	38.0
671	34.4
672	29.8
673	26.4
674	23.3
675	18.7
676	14.0
677	9.3
678	6.6
679	3.2
680	0
681	0
682	0
683	0
684	0
685	0
686	0
687	0
688	0
689	0
690	0
691	0
692	0
693	0
694	2.3
695	5.3
696	7.1
697	10.5
698	14.8
699	18.2
700	21.7
701	23.5
702	26.4
703	28.9
704	26.6
705	26.6
706	29.3
707	30.9
708	32.3
709	34.6
710	36.2
711	36.2
712	35.6
713	36.5
714	37.5
715	37.6
716	36.2
717	34.8
718	33.0
719	29.0
720	24.1
721	19.3
722	14.5
723	10.0
724	7.2
725	4.8
726	3.4
727	0.8
728	0.8
729	5.1
730	10.5
731	15.4
732	20.1
733	22.5
734	25.7
735	29.0
736	31.5
737	34.6
738	37.2
739	39.4
740	41.0
741	42.6
742	43.6
743	44.4
744	44.9
745	45.5
746	46.0

747	46.0
748	45.5
749	45.4
750	45.1
751	44.3
752	43.1
753	41.0
754	37.8
755	34.5
756	30.6
757	26.6
758	24.0
759	20.1
760	15.1
761	10.0
762	4.8
763	2.4
764	2.4
765	0.8
766	0
767	4.8
768	10.1
769	15.4
770	20.8
771	25.4
772	28.2
773	29.6
774	31.4
775	33.3
776	35.4
777	37.3
778	40.2
779	42.6
780	44.3
781	45.1
782	45.5
783	46.5
784	46.5
785	46.5
786	46.3
787	45.9
788	45.5
789	45.5
790	45.5
791	45.4
792	44.4
793	44.3
794	44.3
795	44.3
796	44.3
797	44.3
798	44.3
799	44.4
800	45.1
801	45.9
802	48.3
803	49.9
804	51.5
805	53.1
806	53.1
807	54.1
808	54.7
809	55.2
810	55.0
811	54.7
812	54.7
813	54.6
814	54.1
815	53.3
816	53.1
817	52.3
818	51.5
819	51.3
820	50.9
821	50.7
822	49.2
823	48.3
824	48.1
825	48.1
826	48.1
827	48.1
828	47.6
829	47.5
830	47.5
831	47.2

Time (seconds):	metres per hour)
892	46.5
893	46.4
894	44.6
895	43.5
896	41.0
897	38.1
898	35.4
899	33.0
900	30.9
901	30.9
902	32.3
903	33.6
904	34.4
905	35.4
906	36.4
907	37.3
908	38.6
909	40.2
910	41.8
911	42.8
912	42.8
913	43.1
914	43.5
915	43.8
916	44.7
917	45.2
918	46.3
919	46.6
920	46.7
921	46.8
922	46.7
923	45.2
924	44.3
925	43.6
926	41.6
927	40.2
928	39.4
929	41.0
930	42.8
931	43.8
932	44.7
933	45.2
934	46.3
935	46.6
936	46.7
937	46.8
938	46.7
939	45.2
940	44.3
941	43.6
942	41.6
943	40.2
944	39.4
945	41.0
946	42.8
947	43.8
948	44.7
949	45.2
950	46.3
951	46.6
952	46.7
953	46.8
954	46.7
955	45.2
956	44.3
957	43.6
958	41.6
959	40.2
960	39.4
961	41.0
962	42.8
963	43.8
964	44.7
965	45.2
966	46.3
967	46.6
968	46.7
969	46.8
970	46.7
971	45.2
972	44.3
973	43.6
974	41.6
975	40.2
976	39.4
977	41.0
978	42.8
979	43.8
980	44.7
981	45.2
982	46.3
983	46.6
984	46.7
985	46.8
986	46.7
987	45.2
988	44.3
989	43.6
990	41.6
991	40.2
992	39.4
993	41.0
994	42.8
995	43.8
996	44.7
997	45.2
998	46.3
999	46.6
1,000	46.7
1,001	46.8
1,002	46.7
1,003	45.2
1,004	44.3
1,005	43.6
1,006	41.6

Time (seconds):	metres per hour)
1,007	40.2
1,008	39.4
1,009	41.0
1,010	42.8
1,011	43.8
1,012	44.7
1,013	45.2
1,014	46.3
1,015	46.6
1,016	46.7
1,017	46.8
1,018	46.7
1,019	45.2
1,020	44.3
1,021	43.6
1,022	41.6
1,023	40.2
1,024	39.4
1,025	41.0
1,026	42.8
1,027	43.8
1,028	44.7
1,029	45.2
1,030	46.3
1,031	46.6
1,032	46.7
1,033	46.8
1,034	46.7
1,035	45.2
1,036	44.3
1,037	43.6
1,038	41.6
1,039	40.2
1,040	39.4
1,041	41.0
1,042	42.8
1,043	43.8
1,044	44.7
1,045	45.2
1,046	46.3
1,047	46.6
1,048	46.7
1,049	46.8
1,050	46.7
1,051	45.2
1,052	44.3
1,053	43.6
1,054	41.6
1,055	40.2
1,056	39.4
1,057	41.0
1,058	42.8
1,059	43.8
1,060	44.7
1,061	45.2
1,062	46.3
1,063	46.6
1,064	46.7
1,065	46.8
1,066	46.7
1,067	45.2
1,068	44.3
1,069	43.6
1,070	41.6
1,071	40.2
1,072	39.4
1,073	41.0
1,074	42.8
1,075	43.8
1,076	44.7
1,077	45.2
1,078	46.3
1,079	46.6
1,080	46.7
1,081	46.8
1,082	46.7
1,083	45.2
1,084	44.3
1,085	43.6
1,086	41.6
1,087	40.2
1,088	39.4
1,089	41.0
1,090	42.8
1,091	43.8
1,092	44.7
1,093	45.2
1,094	46.3

Time (seconds):	metres per hour)
1,095	46.6
1,096	46.7
1,097	46.8
1,098	46.7
1,099	45.2
1,100	44.3
1,101	43.6
1,102	41.6
1,103	40.2
1,104	39.4
1,105	41.0
1,106	42.8
1,107	43.8
1,108	44.7
1,109	45.2
1,110	46.3
1,111	46.6
1,112	46.7
1,113	46.8
1,114	46.7
1,115	45.2
1,116	44.3
1,117	43.6
1,118	41.6
1,119	40.2
1,120	39.4
1,121	41.0
1,122	42.8
1,123	43.8
1,124	44.7
1,125	45.2
1,126	46.3
1,127	46.6
1,128	46.7
1,129	46.8
1,130	46.7
1,131	45.2
1,132	44.3
1,133	43.6
1,134	41.6
1,135	40.2
1,136	39.4
1,137	41.0
1,138	42.8
1,139	43.8
1,140	44.7
1,141	45.2
1,142	46.3
1,143	46.6
1,144	46.7
1,145	46.8
1,146	46.7
1,147	45.2
1,148	44.3
1,149	43.6
1,150	41.6
1,151	40.2
1,152	39.4
1,153	41.0
1,154	42.8
1,155	43.8
1,156	44.7
1,157	45.2
1,158	46.3
1,159	46.6
1,160	46.7
1,161	46.8
1,162	46.7
1,163	45.2
1,164	44.3
1,165	43.6
1,166	41.6
1,167	40.2
1,168	39.4
1,169	41.0
1,170	42.8
1,171	43.8
1,172	44.7
1,173	45.2
1,174	46.3
1,175	46.6
1,176	46.7
1,177	46.8
1,178	46.7
1,179	45.2
1,180	44.3
1,181	43.6
1,182	41.6

Time (seconds):	Speed (kilometres per hour)
1,183	13.5
1,184	10.9
1,185	5.6
1,186	0.3
1,187	0
1,188	0
1,189	0
1,190	0
1,191	0
1,192	0
1,193	0
1,194	0
1,195	0
1,196	0
1,197	0.3
1,198	2.4
1,199	5.6
1,200	10.5
1,201	15.8
1,202	19.3
1,203	20.8
1,204	20.9
1,205	20.3
1,206	20.6
1,207	21.1
1,208	21.1
1,209	22.5
1,210	24.9
1,211	27.4
1,212	29.9
1,213	31.7
1,214	33.8
1,215	34.6
1,216	35.1
1,217	35.1
1,218	34.6
1,219	34.1
1,220	34.6
1,221	35.1
1,222	35.4
1,223	35.2
1,224	34.9
1,225	34.6
1,226	34.8
1,227	34.4
1,228	32.3
1,229	31.4
1,230	30.9

Time (seconds):	Speed (kilometres per hour)
1,231	31.5
1,232	31.9
1,233	32.2
1,234	31.4
1,235	28.2
1,236	24.9
1,237	20.9
1,238	16.1
1,239	12.9
1,240	9.7
1,241	6.4
1,242	4.0
1,243	1.1
1,244	0
1,245	0
1,246	0
1,247	0
1,248	0
1,249	0
1,250	0
1,251	0
1,252	1.6
1,253	1.6
1,254	1.6
1,255	1.6
1,256	1.6
1,257	2.6
1,258	4.8
1,259	6.4
1,260	8.0
1,261	10.1
1,262	12.9
1,263	16.1
1,264	16.9
1,265	15.3
1,266	13.7
1,267	12.2
1,268	14.2
1,269	17.7
1,270	22.5
1,271	27.4
1,272	31.4
1,273	33.8
1,274	35.1
1,275	35.7
1,276	37.0
1,277	38.0
1,278	38.8

Time (seconds):	Speed (kilometres per hour)
1279	39.4
1280	39.4
1281	38.6
1282	37.8
1283	37.8
1284	37.8
1,285	37.8
1,286	37.8
1,287	37.8
1,288	38.6
1,289	38.8
1,290	39.4
1,291	39.8
1,292	40.2
1,293	40.0
1,294	41.2
1,295	41.4
1,296	41.8
1,297	42.2
1,298	43.5
1,299	44.7
1,300	45.5
1,301	46.7
1,302	46.8
1,303	46.7
1,304	45.1
1,305	39.8
1,306	34.4
1,307	29.1
1,308	23.8
1,309	18.5
1,310	13.2
1,311	7.9
1,312	2.6
1,313	0
1,314	0
1,315	0
1,316	0
1,317	0
1,318	0
1,319	0
1,320	0
1,321	0
1,322	0
1,323	0
1,324	0
1,325	0
1,326	0

Time (seconds):	Speed (kilometres per hour)
1,327	0
1,328	0
1,329	0
1,330	0
1,331	0
1,332	0
1,333	0
1,334	0
1,335	0
1,336	0
1,337	0
1,338	2.4
1,339	7.7
1,340	13.0
1,341	18.3
1,342	21.2
1,343	24.3
1,344	27.9
1,345	29.5
1,346	31.4
1,347	32.7
1,348	34.3
1,349	35.2
1,350	35.6
1,351	36.0
1,352	35.4
1,353	34.8
1,354	34.0
1,355	33.0
1,356	32.2
1,357	31.5
1,358	29.8
1,359	28.2
1,360	26.6
1,361	24.9
1,362	22.5
1,363	17.7
1,364	12.9
1,365	8.4
1,366	4.0
1,367	0
1,368	0
1,369	0
1,370	0
1,371	0

(c) EPA Urban Dynamometer Driving Schedule for motorcycles with engine displacements less than 170 cc (10.4 cu. in.).

Speed Versus Time Sequence

Time (seconds):	Speed (kilometres per hour)
1	0
2	0
3	0
4	0
5	0
6	0
7	0
8	0
9	0
10	0
11	0
12	0
13	0

Time (seconds):	Speed (kilometres per hour)
14	0
15	0
16	0
17	0
18	0
19	0
20	0
21	4.8
22	9.5
23	13.8
24	18.5
25	23.0
26	27.2

Time (seconds):	Speed (kilometres per hour)
27	27.8
28	29.1
29	33.8
30	34.9
31	36.0
32	36.2
33	35.6
34	34.8
35	33.6
36	32.8
37	31.9
38	27.4
39	24.0

Time (seconds):	Speed (kilometres per hour)
40	24.0
41	24.8
42	24.9
43	25.7
44	27.5
45	30.7
46	34.0
47	36.5
48	36.9
49	36.5
50	36.4
51	34.3
52	30.6

Time (seconds):	Speed (kilometres per hour)
53	27.5
54	25.4
55	25.4
56	28.5
57	31.9
58	34.8
59	37.3
60	38.9
61	39.6
62	40.1
63	40.2
64	39.6
65	39.4
66	39.8
67	39.9
68	39.8
69	39.6
70	39.6
71	40.4
72	41.2
73	41.4
74	40.9
75	40.1
76	40.2
77	40.9
78	41.8
79	41.8
80	41.4
81	42.0
82	43.0
83	44.3
84	46.0
85	47.2
86	48.0
87	48.4
88	48.9
89	49.4
90	49.4
91	49.1
92	48 9
93	48 8
94	48.9
95	49.6
96	48.9
97	48.1
98	47.5
99	48.0
100	48.8
101	49.4
102	49.7
103	49.9
104	49.7
105	48.9
106	48.0
107	48.1
108	48.6
109	49.4
110	50.2
111	51.2
112	51.8
113	52.1
114	51.8
115	51.0
116	46.0
117	40.7
118	35.4
119	30.1
120	24.8
121	19.5
122	14.2
123	8.9
124	3.5
125	0
126	0
127	0
128	0
129	0
130	0
131	0
132	0
133	0
134	0
135	0
136	0

Time (seconds):	Speed (kilometres per hour)
137	0
138	0
139	0
140	0
141	0
142	0
143	0
144	0
145	0
146	0
147	0
148	0
149	0
150	0
151	0
152	0
153	0
154	0
155	0
156	0
157	0
158	0
159	0
160	0
161	0
162	0
163	0
164	3.4
165	6.8
166	10.3
167	13.7
168	17.1
169	20.5
170	23.0
171	25.2
172	26.7
173	27.4
174	26.6
175	26.0
176	25.6
177	25.9
178	26.1
179	26.3
180	26.7
181	28.2
182	27.5
183	24.9
184	23.5
185	20.1
186	18.3
187	17.8
188	18.6
189	19.3
190	20.7
191	23.0
192	25.4
193	28.3
194	31.6
195	34.7
196	37.5
197	38.6
198	40.7
199	42.0
200	43.6
201	45.1
202	46.7
203	47.7
204	48.5
205	49.2
206	49.2
207	49.0
208	48.9
209	48.7
210	48.7
211	48.7
212	48.7
213	48.7
214	48.9
215	49.1
216	49.6
217	50.2
218	50.9
219	51.3
220	51.6

Time (seconds):	Speed (kilometres per hour)
221	51.4
222	51.6
223	53.4
224	54.1
225	55.1
226	56.0
227	56.6
228	56.9
229	57.0
230	56.9
231	56.6
232	56.6
233	56.8
234	57.1
235	57.5
236	57.7
237	58.1
238	58.3
239	58.6
240	58.7
241	58.7
242	58.6
243	58.5
244	58.5
245	58.5
246	58.5
247	58.5
248	58.4
249	58.1
250	57.8
251	57.1
252	56.6
253	56.2
254	55.9
255	55.6
256	55.5
257	55.8
258	55.9
259	56.0
260	56.0
261	55.7
262	55.3
263	54.9
264	54.5
265	54.0
266	54.3
267	53.9
268	53.8
269	53.6
270	53.4
271	53.5
272	53.7
273	54.0
274	54.4
275	54.9
276	55.4
277	55.9
278	56.9
279	57.4
280	57.6
281	58.0
282	58.0
283	57.8
284	57.2
285	56.5
286	55.5
287	54.4
288	53.4
289	53.4
290	53.4
291	52.9
292	51.9
293	51.8
294	51.9
295	51.8
296	51.4
297	51.3
298	51.3
299	51.3
300	50.9
301	50.3
302	49.8
303	48.9
304	47.8

Time (seconds):	Speed (kilometres per hour)
305	46.6
306	45.4
307	44.1
308	43.0
309	41.8
310	39.9
311	38.3
312	36.5
313	35.0
314	33.7
315	32.6
316	31.7
317	31.6
318	31.1
319	30.0
320	28.5
321	25.7
322	23.3
323	20.8
324	19.8
325	19.2
326	17.6
327	16.1
328	12.9
329	11.2
330	8.3
331	4.9
332	1.5
333	0
334	0
335	0
336	0
337	0
338	0
339	0
340	0
341	0
342	0
343	0
344	0
345	0
346	0
347	1.6
348	6.9
349	12.2
350	17.5
351	22.9
352	27.8
353	32.2
354	36.2
355	38.1
356	40.0
357	42.8
358	45.2
359	48.3
360	49.6
361	50.9
362	51.7
363	52.8
364	54.1
365	55.5
366	55.7
367	56.2
368	56.0
369	55.5
370	55.8
371	57.1
372	57.9
373	57.9
374	57.9
375	57.9
376	57.9
377	57.9
378	58.1
379	58.6
380	58.7
381	58.6
382	57.9
383	56.5
384	54.9
385	53.9
386	50.5
387	46.7
388	41.4

Time (seconds):	Speed (kilometres per hour)
389	37.0
390	32.7
391	28.2
392	23.3
393	19.3
394	14.0
395	8.7
396	3.4
397	0
398	0
399	0
400	0
401	0
402	0
403	4.2
404	9.5
405	14.8
406	20.1
407	25.4
408	30.7
409	36.0
410	40.2
411	41.2
412	44.3
413	46.7
414	48.3
415	48.4
416	48.3
417	47.8
418	47.2
419	46.3
420	45.1
421	40.2
422	34.9
423	29.6
424	24.3
425	19.0
426	13.7
427	8.4
428	3.1
429	0
430	0
431	0
432	0
433	0
434	0
435	0
436	0
437	0
438	0
439	0
440	0
441	0
442	0
443	0
444	0
445	0
446	0
447	0
448	5.3
449	10.6
450	15.9
451	21.2
452	26.6
453	31.9
454	37.2
455	42.5
456	44.7
457	46.8
458	50.7
459	53.1
460	54.1
461	56.0
462	56.6
463	57.3
464	58.1
465	57.9
466	58.1
467	58.3
468	57.9
469	57.6
470	57.9
471	57.8
472	57.3

Time (seconds):	Speed (kilometres per hour)
473	57.1
474	57.0
475	56.6
476	56.6
477	56.6
478	56.6
479	56.6
480	56.6
481	56.3
482	56.6
483	56.6
484	57.1
485	56.6
486	56.3
487	56.3
488	56.3
489	56.0
490	55.7
491	55.6
492	53.9
493	51.6
494	48.4
495	45.1
496	41.0
497	36.2
498	31.9
499	26.6
500	21.2
501	16.6
502	11.6
503	6.4
504	1.6
505	0
506	0
507	0
508	0
509	0
510	0
511	1.9
512	5.6
513	8.9
514	10.6
515	13.7
516	15.4
517	16.9
518	19.2
519	22.5
520	25.7
521	28.5
522	30.6
523	32.3
524	33.8
525	35.4
526	37.0
527	38.3
528	39.4
529	40.1
530	40.2
531	40.2
532	40.2
533	40.2
534	40.2
535	40.2
536	41.2
537	41.5
538	41.8
539	41.2
540	40.6
541	40.2
542	40.2
543	40.2
544	39.3
545	37.2
546	31.9
547	26.6
548	21.2
549	15.9
550	10.6
551	5.3
552	0
553	0
554	0
555	0
556	0

Time (seconds):	Speed (kilometres per hour)
557	0
558	0
559	0
560	0
561	0
562	0
563	0
564	0
565	0
566	0
567	0
568	0
569	5.3
570	10.6
571	15.9
572	20.9
573	23.5
574	25.7
575	27.4
576	27.4
577	27.4
578	28.2
579	28.5
580	28.5
581	28.2
582	27.4
583	27.2
584	26.7
585	27.4
586	27.5
587	27.4
588	26.7
589	26.6
590	26.6
591	26.7
592	27.4
593	28.3
594	29.8
595	30.9
596	32.5
597	33.8
598	34.0
599	34.1
600	34.8
601	35.4
602	36.0
603	36.2
604	36.2
605	36.2
606	36.5
607	38.1
608	40.4
609	41.8
610	42.6
611	43.5
612	42.0
613	36.7
614	31.4
615	26.1
616	20.8
617	15.4
618	10.1
619	4.8
620	0
621	0
622	0
623	0
624	0
625	0
626	0
627	0
628	0
629	0
630	0
631	0
632	0
633	0
634	0
635	0
636	0
637	0
638	0
639	0
640	0

Time (seconds):	Speed (kilometres per hour)
641	0
642	0
643	0
644	0
645	0
646	3.2
647	7.2
648	12.6
649	16.4
650	20.1
651	22.6
652	24.6
653	28.2
654	31.5
655	33.8
656	35.7
657	37.5
658	39.4
659	40.7
660	41.2
661	41.8
662	42.0
663	42.2
664	42.2
665	42.5
666	42.6
667	42.6
668	41.8
669	41.8
670	38.0
671	34.4
672	29.8
673	26.4
674	23.3
675	18.7
676	14.0
677	9.3
678	5.6
679	3.2
680	0
681	0
682	0
683	0
684	0
685	0
686	0
687	0
688	0
689	0
690	0
691	0
692	0
693	0
694	2.3
695	5.3
696	7.1
697	10.5
698	14.8
699	18.2
700	21.7
701	23.5
702	26.4
703	26.9
704	26.6
705	26.6
706	29.3
707	30.9
708	32.3
709	34.6
710	36.2
711	36.2
712	35.6
713	36.6
714	37.6
715	37.8
716	36.2
717	34.8
718	33.0
719	29.6
720	24.1
721	19.3
722	14.8
723	10.0
724	7.3

Time (seconds):	Speed (kilometres per hour)
725	4.8
726	3.6
727	0.8
728	0.8
729	5.1
730	10.5
731	15.4
732	20.1
733	22.5
734	25.7
735	29.0
736	31.5
737	34.6
738	37.2
739	39.4
740	41.0
741	42.6
742	43.6
743	44.4
744	44.9
745	45.5
746	46.0
747	46.0
748	45.5
749	45.4
750	45.1
751	44.3
752	43.1
753	41.0
754	37.8
755	34.6
756	30.6
757	26.6
758	24.0
759	20.1
760	15.1
761	10.0
762	4.8
763	2.4
764	2.4
765	0.8
766	0
767	4.8
768	10.1
769	15.4
770	20.8
771	25.4
772	28.2
773	29.6
774	31.4
775	33.3
776	35.4
777	37.3
778	40.2
779	42.6
780	44.3
781	45.1
782	45.5
783	46.5
784	46.5
785	46.5
786	46.3
787	45.9
788	45.5
789	45.5
790	45.5
791	45.4
792	44.4
793	44.3
794	44.3
795	44.3
796	44.3
797	44.3
798	44.3
799	44.4
800	45.1
801	45.9
802	48.3
803	49.9
804	51.5
805	53.1
806	53.1
807	54.1
808	54.7
809	55.2
810	56.0
811	54.7
812	54.7
813	54.6
814	54.1
815	53.3
816	53.1
817	52.3
818	51.5
819	51.3
820	50.9
821	50.7
822	49.2
823	48.3
824	48.1
825	48.1
826	48.1
827	48.1
828	47.6
829	47.5
830	47.5
831	47.2
832	46.5
833	45.4
834	44.6
835	43.5
836	41.0
837	38.1
838	35.4
839	33.0
840	30.9
841	30.9
842	32.3
843	33.6
844	34.4
845	35.4
846	36.4
847	37.3
848	38.6
849	40.2
850	41.8
851	42.8
852	42.8
853	43.1
854	43.5
855	43.8
856	44.7
857	45.2
858	46.3
859	46.5
860	46.7
861	46.8
862	46.7
863	45.2
864	44.3
865	43.5
866	41.5
867	40.2
868	39.4
869	39.9
870	40.4
871	41.0
872	41.4
873	42.2
874	43.3
875	44.3
876	44.7
877	45.7
878	46.7
879	47.0
880	46.8
881	46.7
882	46.5
883	45.9
884	45.2
885	45.1
886	45.1
887	44.4
888	43.8
889	42.8
890	43.5
891	44.3
892	44.7
893	45.1
894	44.7
895	45.1
896	45.1
897	45.1
898	44.6
899	44.1
900	43.3
901	42.8
902	42.6
903	42.6
904	42.6
905	42.3
906	42.2
907	42.2
908	41.7
909	41.2
910	41.2
911	41.7
912	41.5
913	41.0
914	39.6
915	37.8
916	35.7
917	34.8
918	34.8
919	34.9
920	36.4
921	37.7
922	38.6
923	38.9
924	39.3
925	40.1
926	40.4
927	40.6
928	40.7
929	41.0
930	40.6
931	40.2
932	40.2
933	40.2
934	39.8
935	39.4
936	39.1
937	39.1
938	39.4
939	40.2
940	40.2
941	39.6
942	39.6
943	38.8
944	39.4
945	40.4
946	41.2
947	40.4
948	38.6
949	35.4
950	32.3
951	27.2
952	21.9
953	16.6
954	11.3
955	6.0
956	0.6
957	0
958	0
959	0
960	3.2
961	8.5
962	13.8
963	19.2
964	24.5
965	28.2
966	29.9
967	32.2
968	34.0
969	35.4
970	37.0
971	39.4
972	42.3
973	44.3
974	45.2
975	45.7
976	45.9
977	45.9
978	45.9
979	44.6
980	44.3
981	43.8
982	43.1
983	42.6
984	41.8
985	41.4
986	40.6
987	38.6
988	36.4
989	34.6
990	34.6
991	35.1
992	36.2
993	37.0
994	36.7
995	36.7
996	37.0
997	36.5
998	36.5
999	36.5
1,000	37.8
1,001	38.6
1,002	39.6
1,003	39.9
1,004	40.4
1,005	41.0
1,006	41.2
1,007	41.0
1,008	40.2
1,009	38.8
1,010	38.1
1,011	37.3
1,012	36.9
1,013	36.2
1,014	35.4
1,015	34.8
1,016	33.0
1,017	28.2
1,018	22.9
1,019	17.5
1,020	12.2
1,021	6.9
1,022	1.6
1,023	0
1,024	0
1,025	0
1,026	0
1,027	0
1,028	0
1,029	0
1,030	0
1,031	0
1,032	0
1,033	0
1,034	0
1,035	0
1,036	0
1,037	0
1,038	0
1,039	0
1,040	0
1,041	0
1,042	0
1,043	0
1,044	0
1,045	0
1,046	0
1,047	0
1,048	0
1,049	0
1,050	0
1,051	0
1,052	0
1,053	1.9
1,054	6.4
1,055	11.7
1,056	17.1
1,057	22.4
1,058	27.4

Time (seconds):	Speed (kilometres per hour)
1,059	29.8
1,060	32.2
1,061	35.1
1,062	37.0
1,063	38.6
1,064	39.9
1,065	41.2
1,066	42.6
1,067	43.1
1,068	44.1
1,069	44.9
1,070	45.5
1,071	45.1
1,072	44.3
1,073	43.5
1,074	43.5
1,075	42.3
1,076	39.4
1,077	36.2
1,078	34.6
1,079	33.2
1,080	29.0
1,081	24.1
1,082	19.8
1,083	17.9
1,084	17.1
1,085	16.1
1,086	15.3
1,087	14.6
1,088	14.0
1,089	13.8
1,090	14.2
1,091	14.5
1,092	14.0
1,093	13.8
1,094	12.9
1,095	11.3
1,096	8.0
1,097	6.8
1,098	4.2
1,099	1.6
1,100	0.9
1,101	0.2
1,102	1.0
1,103	2.6
1,104	5.8
1,105	11.1
1,106	16.1
1,107	20.6
1,108	22.5
1,109	23.3
1,110	25.7
1,111	29.1
1,112	32.2
1,113	33.6
1,114	34.1
1,115	34.3
1,116	34.4
1,117	34.9
1,118	36.2
1,119	37.0
1,120	38.3
1,121	39.4
1,122	40.2
1,123	40.1
1,124	39.9
1,125	40.2
1,126	40.9
1,127	41.5
1,128	41.8
1,129	42.5
1,130	42.8
1,131	43.3
1,132	43.6
1,133	43.5
1,134	43.5
1,135	43.3
1,136	43.1
1,137	43.1
1,138	42.8
1,139	42.5
1,140	41.8

Time (seconds):	Speed (kilometres per hour)
1,141	41.0
1,142	39.6
1,143	37.8
1,144	34.6
1,145	33.3
1,146	28.2
1,147	25.7
1,148	22.5
1,149	17.2
1,150	11.0
1,151	6.6
1,152	1.3
1,153	0
1,154	0
1,155	0
1,156	0
1,157	0
1,158	0
1,159	0
1,160	0
1,161	0
1,162	0
1,163	0
1,164	0
1,165	0
1,166	0
1,167	0
1,168	0
1,169	3.4
1,170	8.7
1,171	14.0
1,172	19.3
1,173	24.6
1,174	29.9
1,175	34.0
1,176	37.0
1,177	37.8
1,178	37.0
1,179	36.2
1,180	32.2
1,181	26.9
1,182	21.6
1,183	16.3
1,184	10.9
1,185	5.6
1,186	0.3
1,187	0
1,188	0
1,189	0
1,190	0
1,911	0
1,192	0
1,193	0.0
1,194	0.0
1,195	0.0
1,196	0.0
1,197	0.3
1,198	2.4
1,199	5.6
1,200	10.5
1,201	15.8
1,202	19.3
1,203	20.8
1,204	20.9
1,205	20.3
1,206	20.6
1,207	21.1
1,208	21.1
1,209	22.5
1,210	24.9
1,211	27.4
1,212	29.9
1,213	31.7
1,214	33.8
1,215	34.6
1,216	35.1
1,217	35.1
1,218	34.6
1,219	34.1
1,220	34.6
1,221	35.1
1,222	35.4
1,223	35.2

Time (seconds):	Speed (kilometres per hour)
1,224	34.9
1,225	34.6
1,226	34.6
1,227	34.4
1,228	33.3
1,229	31.4
1,230	30.9
1,231	31.5
1,232	31.9
1,233	32.2
1,234	31.4
1,235	28.2
1,236	24.9
1,237	20.9
1,238	16.1
1,239	12.9
1,240	9.7
1,241	6.4
1,242	4.0
1,243	1.1
1,244	0
1,245	0
1,246	0
1,247	0
1,248	0
1,249	0
1,250	0
1,251	0
1,252	1.6
1,253	1.6
1,254	1.6
1,255	1.6
1,256	1.6
1,257	2.6
1,258	4.8
1,259	6.4
1,260	8.0
1,261	10.1
1,262	12.9
1,263	16.1
1,264	16.9
1,265	16.3
1,266	13.7
1,267	12.2
1,268	14.2
1,269	17.7
1,270	22.5
1,271	27.4
1,272	31.4
1,273	33.8
1,274	35.1
1,275	35.7
1,276	37.0
1,277	38.0
1,278	38.8
1,279	39.4
1,280	39.4
1,281	38.6
1,282	37.8
1,283	37.8
1,284	37.8
1,285	37.8
1,286	37.8
1,287	37.8
1,288	38.6
1,289	38.8
1,290	39.4
1,291	39.8
1,292	40.2
1,293	40.9
1,294	41.2
1,295	41.4
1,296	41.8
1,297	42.2

Time (seconds):	Speed (kilometres per hour)
1,298	43.6
1,299	44.7
1,300	45.5
1,301	46.7
1,302	46.8
1,303	46.7
1,304	45.1
1,305	39.8
1,306	34.4
1,307	29.1
1,308	23.8
1,309	18.5
1,310	13.2
1,311	7.9
1,312	2.6
1,313	0
1,314	0
1,315	0
1,316	0
1,317	0
1,318	0
1,319	0
1,320	0
1,321	0
1,322	0
1,323	0
1,324	0
1,325	0
1,326	0
1,327	0
1,328	0
1,329	0
1,330	0
1,331	0
1,332	0
1,330	0
1,334	0
1,335	0
1,336	0
1,337	0
1,338	2.4
1,339	7.7
1,340	13.0
1,341	18.3
1,342	21.2
1,343	24.3
1,344	27.0
1,345	29.5
1,346	31.4
1,347	32.7
1,348	34.3
1,349	35.2
1,350	35.6
1,351	36.0
1,352	35.4
1,353	34.8
1,354	34.0
1,355	33.0
1,356	32.2
1,357	31.5
1,358	29.8
1,359	28.2
1,360	26.6
1,361	24.9
1,362	23.5
1,363	17.7
1,364	12.9
1,365	8.4
1,366	4.0
1,367	0
1,368	0
1,369	0
1,970	0
1,971	0

2. Appendix IV is revised to read as follows:

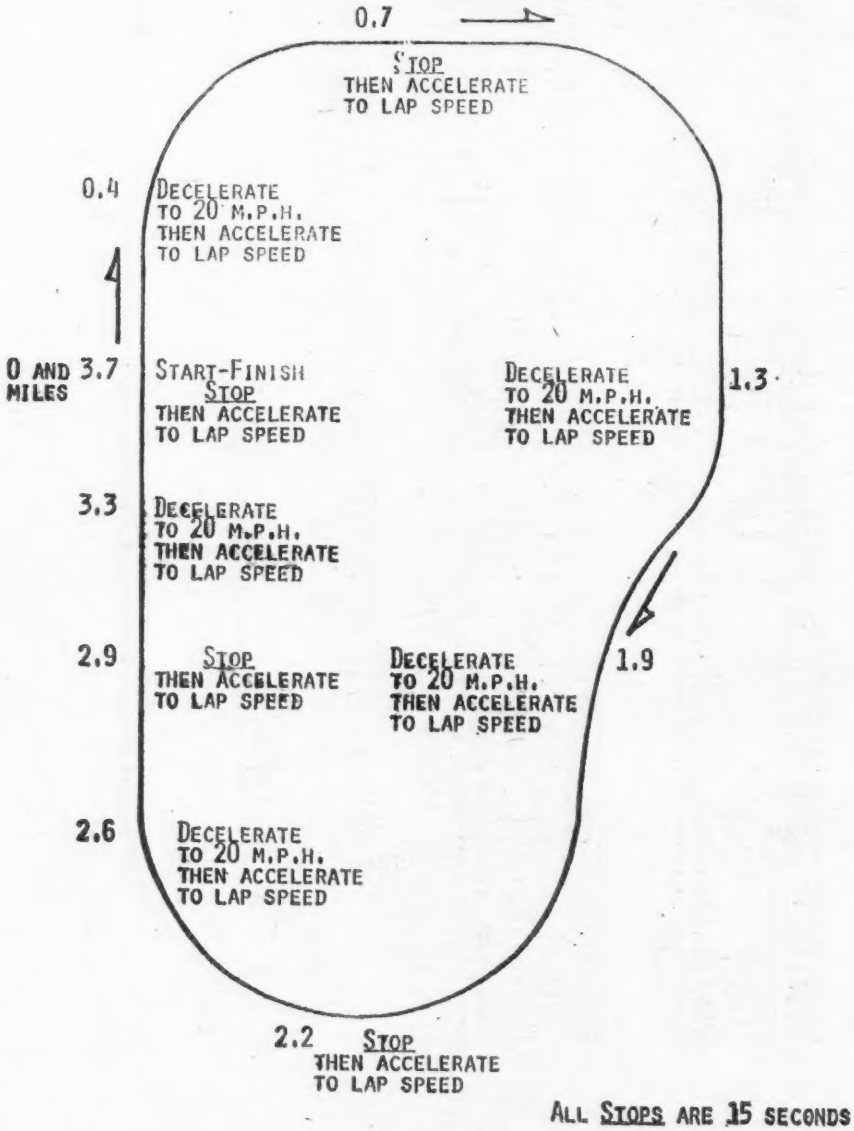
APPENDIX IV—DURABILITY DRIVING SCHEDULES

(a) Durability Driving Schedule for Light Duty Vehicles and Light Duty Trucks.

The schedule consists basically of 11 laps of a 3.7 mile course. The basic vehicle speed for each lap is listed below:

Lap:	*Speed miles per hour*
1	40
2	30
3	40
4	40
5	35
6	30
7	35
8	45
9	35
10	55
11	70

During each of the first nine laps there are 4 stops with 15 second idle. Normal accelerations and decelerations are used. In addition, there are 5 light decelerations each lap from the base speed to 20 m.p.h. followed by light accelerations to the base speed.



The 10th lap is run at a constant speed of 55 m.p.h.

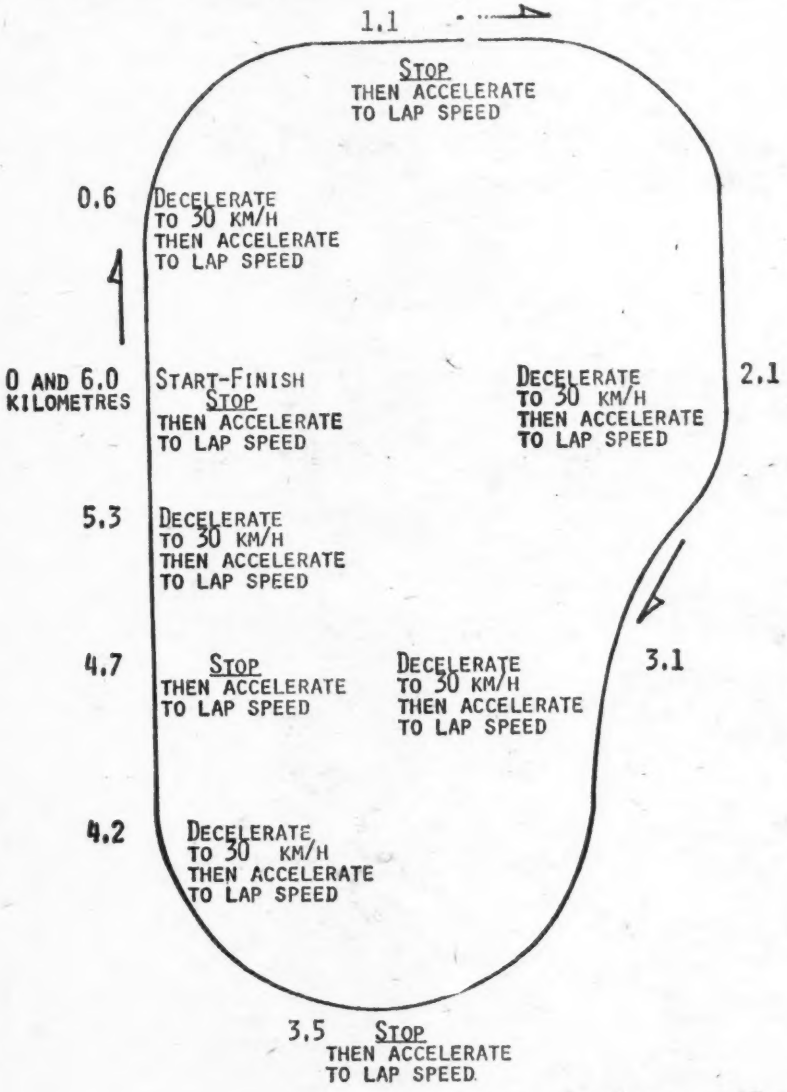
The 11th lap is begun with a wide open throttle acceleration from stop to 70 m.p.h. A normal deceleration to idle followed by a second wide open throttle acceleration occurs at the midpoint of the lap.

(b) Durability Driving Schedule for Motorcycles. The Durability Driving Schedule for Class III Motorcycles may be used for Light Duty Vehicles and Light Duty Trucks.

The schedule consists basically of 11 laps of a 6.0 km (3.7 mi) course. The basic vehicle speed for each lap is listed below:

Speed (kilometers per hour)

Lap	Class I	Class II	Class III
1	65	66	65
2	45	45	45
3	65	65	65
4	65	65	65
5	55	55	55
6	45	45	45
7	55	55	55
8	70	70	70
9	55	55	55
10	70	90	90
11	70	90	110



ALL STOPS ARE 15 SECONDS

During each of the first nine laps there are 4 stops with 15 second idle. Normal accelerations and decelerations are used. In addition, there are 5 light decelerations each lap from the base speed to 30 km/h followed by light accelerations to the base speed.

The 10th lap is run at a constant speed.

The 11th lap is begun with a wide open throttle acceleration from stop. A normal deceleration to idle followed by a second wide open throttle acceleration occurs at the midpoint of the lap.

This schedule may be modified with the advance approval of the Administrator if it results in unsafe operation of the vehicle.

3. Appendix VI is revised to read as follows:

APPENDIX VI—VEHICLE AND ENGINE COMPONENTS

(a) Light Duty Vehicles, Light Duty Trucks, Motorcycles and Gasoline Fueled Heavy Duty Engines.

I. Basic Mechanical Components–Engine.
(1) Intake and exhaust valves.
(2) Drive belts.
(3) Manifold and cylinder head bolts.
(4) Engine oil and filter.
(5) Engine coolant.
(6) Cooling system hoses and connections.
(7) Vacuum fittings, hoses, and connections.
(8) Oil injection metering system.
II. Fuel System.
(1) Fuel specification-octane rating, lead content.
(2) Carburetor-idle RPM, mixture ratio.
(3) Choke mechanism.
(4) Fuel system filter and fuel system lines and connections.
(5) Choke plate and linkage.
III. Ignition Components.
(1) Ignition timing and advance systems.
(2) Distributor breaker points and condenser.
(3) Spark plugs.
(4) Ignition wiring.
(5) Operating parts of distributor.
IV. Crankcase Ventilation System.
(1) PCV valve.
(2) Ventilation hoses.
(3) Oil filler breather cap.
(4) Manifold inlet (carburetor spacer, etc.).
V. External Exhaust Emission Control System.
(1) Secondary air injection system hoses.
(2) Air system manifolds
(3) Control valves and air pump.
(4) Manifold reactors.
(5) Catalytic converters.
(6) Exhaust recirculation.
(7) Water injection.
VI. Evaporative Emission Control System.
(1) Engine compartment hose connections.
(2) Carbon storage media.
(3) Fuel tank pressure-relief valve operation.
(4) Fuel vapor control valves.
VII. Air Inlet Components.
(1) Carburetor air cleaner filter.
(2) Hot air control valve.

(b) Diesel Light Duty Vehicles, Diesel Light Duty Trucks, and Diesel Heavy Duty Engines.

I. Engine Mechanical Components.
(1) Valve train.
(2) Cooling system.
a. Coolant.
b. Thermostat.
c. Filter.
(3) Lubrication.
a. Oil filter.
b. Lubricant.
II. Fuel System.
(1) Fuel type.
(2) Fuel pump.
(3) Fuel filters.
(4) Injectors.
(5) Governor.
III. Air Inlet Components.
(1) Air cleaner.
(2) Inlet ducting.
IV. External Exhaust Emission Control System.
(1) Rack limiting devices (aneroid, throttle delay, etc.).
(2) Manifold reactors.
(3) Catalytic converters.
(4) Exhaust recirculation.
(5) Water injection.

[FR Doc.77-147 Filed 1-4-77;8:45 am]